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# USSR Report

CONSTRUCTION AND RELATED INDUSTRIES

No. 84

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USSR REPORT  
CONSTRUCTION AND RELATED INDUSTRIES

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## CONSTRUCTION PLANNING AND ECONOMICS

### MINISTER INTERVIEWED ON FAR EAST CONSTRUCTION

Moscow LITERATURNAYA ROSSIYA in Russian 3 Dec 82 p 3

[Interview with S. V. Bashilov, minister of USSR Construction in the Far East and Transbaykal Regions (A-U), by E. Maksimovskiy: "It is Not Easy to Gain the Heights", date and place not specified.]

[Text] At the November (1982) CPSU Central Committee Plenum it was stressed that the efficient utilization of the vast resources allocated to economic development, the creation of new capacity, homes, and cultural-service construction is a task of extreme importance. "In addition," It was stated at the CPSU Central Committee Plenum, "there remain several problems in the sphere of major construction." The eastern regions are acquiring an ever greater role in the nation's economy. Capital investments and the construction industry are being concentrated at increasing rates on the main directions in the region's economic and cultural development. This is the subject of a discussion between S. V. Bashilov, minister of the USSR Ministry of Construction in the Far East and Transbaykal Regions, and a correspondent from LITERATURNAYA ROSSIYA.

[Question] Sergey Vasil'evich, your ministry, one of the nation's youngest, was created a little more than two years ago. Not all of our readers are sufficiently acquainted with its activities.

[Answer] First of all one should mention the geography of the operations. They cover the Buryat and Yakut ASSRs, Khabarovsk and Maritime Krays, Kamchatka, Sakhalin, Magadan, and Chita Oblasts. The productive forces are rapidly developing on these areas. The 11th Five-Year Plan makes provisions for capital construction rates which are considerably above the national average. Thus, by 1985 Minvostokstroy's [Ministry of Construction in the Far East and Transbaykal Regions] construction and installation work volume will have almost doubled compared to the high level of the 10th Five-Year Plan. Of the projects in which we are engaged, we give primary importance to the introduction and reconstruction of new enterprises and capacity in the machinery building ministries, the ferrous and nonferrous metallurgy, coal, lumber and wood processing, and the mineral fertilizer industries.

In his speech to the CPSU Central Committee Plenum, comrade Yu. V. Andropov noted that, "It is still necessary to decisively struggle against the scattering of effort and resources upon a multitude of objectives." This is dictated by the pressing interests of accelerating major construction projects.

[Question] Tell us, Sergey Vasil'evich, the largest construction projects entrusted to the ministry.

[Answer] In the period up to 1990 we must complete and turn over a number of mining enterprises. They will add substantially to the raw material base of the nonferrous metallurgy industry. They include: the Orlov, Zhirekensk, Solnechnyy, Maritime, and other mining and concentration combines, and gold mines. The operational introduction of the metallurgical plant at Komsomolsk na Amure will have a substantial effect upon the national economy. More than 300 million rubles will be spent upon this project. When the plant goes into operation deliveries of reinforcing steel to the Far East will be curtailed, local resources of scrap metal will be used.

[Question] The formation of the first territorial production complex in the BAM [Baykal-Amur Mainline] is under way in southern Yakutia. The problems which must be solved in Neryungra and Yakutsk are, in the main, typical for the eastern regions. Could you please point out the most important of them?

[Answer] Construction industry enterprise capacity cannot meet the sharply growing demands. This is why the ministry is allocating to the development of its own production base double the resources that it did during the same period of time in the second half of the 1970's. We are primarily directing capital investments towards the reconstruction, expansion, and creation of new plants for large panel home building. We are talking about balance in the social service standards of production collectives and the creation of advantages to living in the Far East.

The implementation of this program will make it possible to increase the production of parts and structures of improved design homes up to one million square meters. A plant for the rapid production of container type buildings will be built in order to facilitate construction in inaccessible regions. Then we will be able to rapidly erect comfortable pioneer and temporary assignment settlements with complete social service facilities.

[Question] The example you have given sketches the position and approach to the solution of labor and living problems in the Far East and the Transbaykal regions. However, you spoke about large panel home building. Evidently, one must take the region's conditions into consideration.

[Answer] There is an acute shortage of workers in the Far East. This is why our main efforts are directed towards the modernization, or more accurately, the reequipping of the construction industry.

We must expand the assortment of progressive materials, prestressed and light structures, effective insulation, and decorative items. We still have to haul rolled metal items and cement in from other economic regions.

Our zone has a very complex and variegated climate. There are regions with average annual negative temperatures of significant magnitudes. Permafrost is as far down as Chita Oblast itself, while the moist subtropics are not far from the Amur. Earthquakes, seasonal deluge rains, typhoons, tsunamis, storms and winds are all encountered by builders.

Great difficulties in conducting earthmoving work are caused by the fact that the machinery building industry in our nation does not equip earthmoving and other construction-installation machinery for northern use, capable of trouble-free operation on permafrost ground with temperatures down to minus 50 degrees.

In various climatic zones it is necessary to specially heat windows, apply caulking between panels and masonry, lay piping and conduit, and lay foundations all in a particular manner. In short, general, standard solutions cannot be applied everywhere. In the meanwhile we must find a special approach to every specific case. I think that the collectives of construction research institutes have a great obligation to builders in the Far East and the Transbaykal regions.

[Question] The labor resources in the region are not great. Siberia and the Far East have 59.1 percent of the nation's territory and 10.7 percent of its population. As we know, the ministry needs a large number of workers and specialists.

[Answer] We count upon the immigration of key personnel from other regions. In order to provide for newcomers it is necessary to construct at least 6,000 apartments and dormitories for 40,000 people. Personnel and housing are mutually related problems. If there were apartments there would be workers and specialists. When there is no housing there are no workers and nobody to build it. Is it a vicious circle? It should be broken. This was indicated at the 26th CPSU Congress: "People leave Siberia, for example, most frequently not because they do not like the climate or the wages, but because it is difficult to find housing, put the children in a kindergarten, and there are not enough cultural centers."

For this reason economists say that increasing the adaptability of newcomers to the nation's eastern regions would markedly reduce material outlays involving the development of new territories. The accelerated development of social infrastructure is an important way of attaining this goal. In particular, it is essential to improve municipal and personal services, to reliably supply the population with a wide assortment of consumer goods, and, in the final account, create a complex of living conditions that are favorable and attractive to people.

It is essential to continue the construction of housing. It must be considerably bigger and better. During the entire five-year plan we must build 1.5 million square meters of housing just for our own workers and employees.

It is unquestionably not easy to reach such heights. We estimate that the measures we have taken will lead to a sharp change in the situation: the waiting lines for housing will shrink, migration will decline, and work collectives will become more stable. As a result the productive capacity of miners, metallurgists, and power engineering workers will go into operation sooner.

[Question] The November CPSU Central Committee Plenum considered it especially necessary that the implementation of the Food Program be discussed everywhere. One of the tasks facing workers in the nation's eastern regions is to supply the population with products mainly from local resources. How is this work going at Minvostokstroy enterprises and organizations?

[Answer] We have outlined a series of large scale measures. Workers at the Dal'shakhtostroy Trust, Glavvladivstokstroy, SMU-12, and Glavkamchatskstroy, together with the collectives of the USSR Ministry of Installation and Special Construction Work and the Ministry of Agriculture, have begun an initiative for the expansion of socialist competition to beat the deadlines for introducing the Mikhaylov and Ussuriy Poultry Factories in Maritime Kray, and the poultry factory in Kamchatka Oblast. We recommend that this deed become widespread.

During this five-year plan more than 20 agroindustrial complex projects must be put into operation. We will comprehensively assist the development of subsidiary farms at construction organizations.

[Question] The USSR Supreme Soviet session ratified the State Plan for the Economic and Social Development of the USSR in 1983. The plan became law...

[Answer] The year 1983 has been called the heart of the five-year plan. This is, of course, not only because it is in the middle of the economic period. Certain tendencies requiring correction have been pointed out. Thus, the target for major construction for the nation in general has been set somewhat higher than the target for the five-year plan. There is an increased proportion of outlays for equipment. This will improve the technological structure of state capital investments and simultaneously lead to reduced expenditures for construction and installation work. Special attention is being given to the accelerated introduction of capacity and projects. The rubles invested should more quickly turn a profit.

Builders in the Far East and the Transbaykal are concentrating operations and improving their organization. Our tomorrow depends entirely upon how skillfully we work today.

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CSO: 1821/44

CONSTRUCTION MINISTER DESCRIBES BUILDING INNOVATIONS

Moscow BETON I ZHELEZOBETON in Russian No 12, Dec 82 pp 3-6

[Article by USSR Minister of Construction G. A. Karavayev: "The Achievements of Science in the Practice of Construction"]

[Text] Among the tasks of enormous scale, which were posed by the 26th CPSU Congress for the 11th Five-Year Plan, great importance is attached to capital construction.

In implementing the decisions of the congress and the November (1981) CPSU Central Committee Plenum, the collectives of the subdivisions of the USSR Ministry of Construction on the basis of the developed socialist competition are making a worthy contribution to the increase of the production potential of the country, while ensuring the further development of the social program and the increase of the well-being of the Soviet people. During just the first year of the current five-year plan the subdivisions of the ministry ensured the placement into operation of 510 most important production capacities and facilities, including 61 production capacities of paramount state importance, among which are the capacities for the production of 420,000 tons of pig iron at the Rustavi Metallurgical Plant and 9.1 million units of knit underwear in Tskhivali of the Georgian SSR, 10 million units of industrial pipe fittings at the plant of control and stopping fittings in Bologoye of Kalinin Oblast, 1 million tons of coke at the Altayskiy Byproduct Coke Plant and others.

Messages of greeting of General Secretary of the CPSU Central Committee and Chairman of the Presidium of the USSR Supreme Soviet Comrade L. I. Brezhnev were received in connection with the successful completion of the construction and placement into operation of the production capacities of Spinning and Weaving Factory No 2 of the Tiraspol Cotton Production Association in the Moldavian SSR, the Kinsgisepp Fosforit Production Association in Leningrad Oblast and the Pridonskoy Chemical Plant in Voronezh Oblast, while in the speech of Comrade L. I. Brezhnev at the November (1981) CPSU Central Committee Plenum the Main Administration of Construction in Western Regions was named among the best collectives of the sector, which constantly ensure the timely or early placement of projects and capacities into operation.

Along with production projects in 1981 apartment houses with a total useful area of 11.1 million m<sup>2</sup>, as well as schools and children's preschool institutions, hospitals, polyclinics and other cultural and personal facilities were built and put into operation.

During the years of the 9th and 10th Five-Year Plans a powerful material and technical base, which has large enterprises for the production of structural members and parts, was created in the USSR Ministry of Construction. Precast concrete and reinforced concrete structural members as in the past remain the main construction material. The total capacity of the construction industry of the USSR Ministry of Construction for precast reinforced concrete as of the beginning of 1982 came to 18.7 million m<sup>3</sup>, including for the production of parts of large-panel housing construction--11.2 million m<sup>2</sup> of total useful area of housing.

As a result of the development of the operating capacities and the building of new capacities of the construction industry of the ministry the proportion of prefabricated construction in the total amount of construction and installation work increased from 62 percent in 1975 to 77 percent in 1981, including from 60 to 72 percent in housing construction, from 45 to 67 percent in cultural and personal construction and from 70 to 88 percent in agricultural production construction. As during the preceding five-year plan, the further increase of the degree of prefabrication of buildings and structures by the delivery in sets to the construction sites of industrial materials and structural members remains the leading direction in the decrease of the materials-intensiveness of construction, the decrease of the labor expenditures at the construction sites and the expediting of the placement of production capacities and projects into operation. The construction of a number of large industrial complexes: the Izhorskiy zavod Production Association, the Cheboksary Plant of Industrial Tractors and others, is convincing evidence of the effectiveness of this direction.

In recent years particular attention has been devoted by the ministry to the development of capacities for the production of structural members of the connecting version of series II-04, which govern the industrialization of the construction of projects both for cultural and personal and for production purposes. At the beginning of the 11th Five-Year Plan the total capacity of enterprises for the production of structural members of this series came to 1.4 million m<sup>3</sup>. The structural members have been steadily improved, and at present continuous columns with a height of up to four stories have been introduced extensively by the territorial subdivisions. The elimination of the height joints makes it possible to decrease the list of columns to one-fourth to one-half, the consumption of metal by 5-10 percent and the operating time of installation hoisting devices by 20-25 percent and to reduce the labor expenditures in installation work on the average by 30 percent.

Back during the 8th and 9th Five-Year Plans shells of double positive curvature were produced and introduced extensively by the Main Administration of Construction in Western Regions of the USSR Ministry of Construction jointly with Planning Institute No 1 and other institutes of USSR Gosstroy. Their designs were steadily improved from sheets measuring 3X3 m to 3X6 m, the technology of installation was changed from the use of jigs to the changeover to the jigless method. At present industrial and agricultural projects in Leningrad, Riga, Novogorod and Shyaulay, as well as a number of projects in Finland with a total area of more than 1 million m<sup>2</sup> have been built with the use of such shells. Their use as compared with planar structural members provides a saving of cement on the average of up to 30 percent, steel--up to 20 percent and labor expenditures in installation--up to 50 percent. The Main Administration of Construction in Western Regions is continuing to improve the designs of the shells, at present the development of shells made from prestressed reinforced concrete sheets measuring 3X18 m is being carried out.

Starting in 1981 more than 10 territorial subdivisions of the ministry with the active assistance of the Scientific Research Institute of Concrete and Reinforced Concrete began the production and assimilation of large-size sheets "for the span" (mainly like the KZhS) measuring 3 X 18 m and 3 X 24 m. Prestressed reinforced concrete structural members, the volume of which in 1981 came to about 4 million m<sup>3</sup>, became widespread. During the past five-year plan the use of structural members made from concretes of brand M500 and greater, which in 1981 came to more than 73,000 m<sup>3</sup>, increased by 1.5-fold. The volumes of the use of V-I smooth low-carbon wire and mesh made from it, of Vr-I shaped wire, V-II high-strength wire and reinforcing cables are increasing annually, which is providing not less than one-third of the total saving of metal.

The construction organizations of the Main Administration of Construction in Western Regions in close cooperation with the Scientific Research Institute of Concrete and Reinforced Concrete, the Research Institute of Building Structures (Kiev) and other institutes of USSR Gosstroy and other departments were among the first in the country to develop and introduce extensively in practice nondestructive methods of the quality control of reinforced concrete structural members, which made it possible to reduce considerably the performance of mechanical testing with breaking loads. The use of the modern achievements of radio electronics, atomic physics and oscillation and wave theory made it possible to develop, produce and use a wide range of monitoring and testing radio isotope instruments (for the checking of the consistency and moisture content), acoustic instruments (for the checking of deformative properties), as well as electronic instruments (for the testing of the load-carrying capacity). As a result at present in the USSR Ministry of Construction all the territorial subdivisions for the most part are provided with mobile (on the basis of the UAZ-451 and YeRAZ-762) laboratories, while a significant number (98) of the plants of reinforced concrete items and large-panel housing construction are provided with 125 fixed stands for nondestructive methods of the checking of the indicated parameters of reinforced concrete structural members. In the ministry at present about half of all the structural members being produced are checked by nondestructive methods. The complete abandonment of destructive tests of 60 percent of the controls and 1 percent of the finished structural members is the ultimate goal of the solution of the indicated problem, which will provide on the scale of the USSR Ministry of Construction alone an annual saving of about 100,000 m<sup>3</sup> of concrete and 7,000 tons of metal.

Attaching paramount importance to the utmost economy of material and technical resources, and first of all metal and cement, during the past period the USSR Ministry of Construction carried out the changeover of 69 of the 87 enterprises of large-panel housing construction to the production of panels of the floor and walls with economical reinforcement, which annually saves up to 4,200 tons of metal. Stamped embedded fittings, which provide an annual saving of about 400 tons of rolled metal products, have been introduced at 28 house building combines. Many enterprises, which produce precast reinforced concrete structural members for industrial construction, are using light-weight embedded fittings, saving in this case up to 1,000 tons of metal.

Using advanced domestic and foreign know-how, the staff members of the Stroyindustriya Special Design and Technological Bureau of the USSR Ministry of Construction jointly with the Kalinin Reference Model House Building Combine on the basis of the assemblies and parts of the prefabricated units, which are series produced by



domestic industry, developed an industrial prefabricated unit conveyor line for the production of the interior wall panels of large-panel houses with a productivity of 30,000 m<sup>3</sup> a year, which provides 150,000 m<sup>2</sup> of total space of buildings. The metal content of the equipment of this line is 370 tons, the installed capacity is 250 kW, the output per square meter of production area is 21.4 m<sup>3</sup>.

As compared with the existing prefabricated unit stand production of the same capacity, this line will make it possible to decrease the production cost of 1 m<sup>3</sup> of items by 2 rubles 43 kopecks, or 17 percent, the labor expenditures--by 22.5 percent, the power expenditures--by 26.6 percent, the specific capital expenditures--by 12.4 percent, the metal content of the equipment--by nearly 30 percent. The quality of the surface of the items and the health conditions for the workers were improved considerably as a result of the decrease of the level of noise and vibration, the ease of the service of the equipment increased.

The Stroyindustriya Special Design and Technological Bureau developed flow charts of the production of panels like the "VS" for plants of large-panel housing construction with a capacity of 50,000, 100,000, 150,000 and 200,000 m<sup>2</sup> of total area a year. Following the development of the pilot model of the prefabricated unit conveyor line at the Kalinin Reference Model House Building Combine the introduction of such lines is planned at a number of house building combines which are being renovated and newly built.

In accomplishing the task of the further development of the industrialization of construction along with the questions on the decrease of its materials-intensiveness, the ministry is attaching great importance to the use of light-weight porous aggregate concretes in load-carrying and enclosing structural members. The many years of cooperation of our ministry with such institutes as the Scientific Research Institute of Concrete and Reinforced Concrete, the Scientific Research Institute of Keramzit, the All-Union Scientific Research Institute of Reinforced Concrete and the Central Scientific Research Institute of Experimental Designing of Trade and Personal Service Buildings made it possible to develop at the reference model plant of the Zhelezobeton Association in the Main Administration of Construction in Ulyanovsk, and then to set up the mass production and introduction of load-carrying and enclosing structural members made of keramzit at the majority of organizations subordinate to the ministry. The production of keramzit slabs of the floors for residential and public buildings by the method of direct striking, as well as of principals with a length of 18 and 24 m, columns of series II-04 (with a height of four stories), large-panel partitions and piles was organized for the first time in the country at the Main Administration of Construction in Ulyanovsk. As a whole for the ministry the production of load-carrying and enclosing structural members made of light-weight concretes came to 3.11 million m<sup>3</sup>, which is 22 percent of the total production volume of precast reinforced concrete.

Owing to the implementation of specific measures, which were aimed at the industrialization of construction and the improvement of the production technology, during 1969-1981 it was possible to achieve a decrease of the consumption of rolled metal products from 77 to 60 kg and of cement from 421 to 335 kg per 1 m<sup>3</sup> of precast reinforced concrete.

Attaching paramount importance to the decrease of the estimated cost of construction and the labor intensity of the work and to the economy of material and



technical resources, and first of all metal and cement, the ministry in the union republics is continuing the development of the technology of erecting monolithic buildings in volumetric travelling forms. The construction of a sanatorium building of mixed design--large-panel and skeleton-panel--has been started in Gagra.

The experience of the experimental construction of buildings in regions with seismic activity merits serious attention. In 1981 the Georgian SSR Ministry of Construction completed an experiment on the construction of a 16-story skeleton-type apartment house in Tbilisi (see the figure on the third page of the cover [figure not reproduced]) and a 9-story large-panel apartment house in Kutaisi (see the figure on the second page of the cover [figure not reproduced]). Using the Yugoslav experience of erecting skeleton-type buildings, the experimental construction of a 16-story, 75-apartment building according to the plan of the Tbilisi Zonal Scientific Research Design Institute of Standard and Experimental Designing of Residential and Public Buildings was envisaged for the purpose of the introduction in the practice of industrial construction of standardized skeleton-panel designs for residential and public buildings with the pretensioning of the steel under construction conditions.

The structural layout of the building is frame-stay. The foundations and first floor are executed in precast reinforced concrete structural members of the skeleton of series IIS-04 with a grid of columns 6 X 6.6 m. The remaining 15 stories are designed in experimental sectional structural members of a collar-beamless system with precast floors made of two corrugated panels per structural unit. The columns are precast and are not cantilevered, are four stories high and have a cross-section of 40 X 40 cm with a free length of the longitudinal reinforcement bars. The joining of the columns is so-called plug-and-socket, when the free lengths of the reinforcement bars from the butt end of one element are led into the holes located on the butt end of another element and are made monolithic by cement slurry. The joining of the columns with the slabs of the floors is carried out in two orthogonal directions by the stressing of the reinforcement made from cables like K-7, which are anchored in the end sections in the gaps between the balcony and side elements by monolithization with concrete.

The preliminary calculation of the technical and economic indicators of the construction of the building attests to the obtaining of a substantial economic impact from the introduction of these structural members in the mass construction of residential and public buildings. Thus, as a result of the replacement of standard load-bearing structural members from the standardized skeleton of series IIS-04 with the experimental sectional structural members of the collar-beamless system for the above-ground section of the building a decrease (in terms of adjusted total area) of the estimated cost by 18.2 percent, the total labor expenditures by 17.9 percent and the consumption of steel in physical terms by 17.2 percent was achieved.

Thus, the indicated building, in our opinion, could become with the appropriate modification the standard for the future construction of buildings of more than nine stories in all the seismically active regions of our country. The experimental apartment house in Kutaisi, in our opinion, can serve as a prototype of buildings of nine stories or less.

The traditional means of reinforcing the items of large-panel houses and of installing structural members at the construction sites in regions with seismic

activity have practically exhausted their possibilities in the area of the decrease of the labor intensity and the economy of metal. The further decrease of the materials-intensiveness of the structural members and of the labor expenditures on their production and installation involves the changeover to more advanced methods which require the radical revision of the notions, on which technological processes are presently based.

The idea of the keying of the elements of the building with the reduction of the structural members with prestressed connecting reinforcement by practicable methods under construction conditions was taken as the basis for the experiment at the construction site of the nine-story large-panel apartment house of series 1-464-AS in Kutaisi. The change of the layout of the reinforcement of the wall panels and the slabs of the floors, which eliminates the numerous free lengths of the reinforcing bars and the cut-outs in the concrete, is the main merits of the new design decision, which was worked out by the Georgian Affiliate of the Stroyindustriya Special Design and Technological Bureau in close cooperation with the Scientific Research Institute of Concrete and Reinforced Concrete, the Central Scientific Research and Planning Institute of Standard and Experimental Designing of Housing, the Central Scientific Research Institute of Construction Design imeni Kucherenko and the Tbilisi Zonal Scientific Research Design Institute of Standard and Experimental Designing of Residential and Public Buildings. This considerably facilitates the molding and striking of the structural members and the conditions of the transportation, storage and installation of the structural members at the construction site. The development of a system of the forced installation of the structural members, the sharp decrease of the amount of welding work and the formless concreting of the keyed joints decrease considerably the need for highly skilled workers at the construction site. As a result, and this is the most important thing, the creation of prestressing in the load-carrying structural members and in the building as a whole by the tensioning of the steel in the plane of the slabs of the floors around the perimeter of the building by the electrothermal method from welding units and of the seven-wire strands in the vertical joints of the external wall panels by the mechanical method by ordinary car jacks is ensured.

The full-scale tests of the completed building for the seismic load and the technical and economic indicators per square meter of total adjusted area attest to the considerable advantages of the proposed method of erecting such buildings over the existing methods. Thus, the total decrease for the indicated indicator with respect to labor expenditures was from 15.6 to 12.8 man-hours, or 18 percent; the consumption of steel in physical terms from 33.4 to 26 kg, or 22.2 percent. The amount of welding work at the construction site was reduced by 82 percent.

It is planned by the comprehensive program of the ministry on the decrease of the materials-intensiveness in construction and industrial production to decrease by 1985 the consumption of metal and cement per 1 million rubles of construction and installation work respectively by 7.2 and 6.2 percent. The improvement of design decisions, the methods of calculation and the production of load-carrying structural members of efficient sections; the increase of the proportion of the output of prestressed structural components for mass purposes; the consolidation of the structural elements, assemblies and blocks of complete plant fabrication, which are delivered in complete sets to the construction site; the extensive introduction of light-weight metal skeletons and floors made of shaped steel plating; the use of economical types of rolled metal products made of high-strength steels,

roll-formed sections, broad I beams and other decisions are the main directions of the decrease of the consumption of material resources.

The ministry has drawn up comprehensive goal programs on the introduction of large-span structural components of floors like the KZhS, the comprehensive goal program "Prolet" and of the structural members of series 1.220-1. It is envisaged to execute single-story buildings by the changeover everywhere to a 12-m spacing with the elimination of the 6-m spacing (the "Karkas" comprehensive goal program). The fulfillment of the "Karkas" program will make it possible by 1985 to replace practically entirely in industrial construction the more materials-consuming structural components of series 1.420 and IIS-20. At present one of the promising directions is the changeover to the designing and construction in prefabricated large-panel design of mass types of public buildings (educational, administrative, trade and personal service, medical and other purposes) with a height of a story of 3.3 m in structural members of series 1.220.1-2, which was developed by institutes of the State Committee for Civil Construction and Architecture. The use of the panel system of this series for the construction of public buildings, as compared with the traditional skeleton-panel system, provides a saving of metal of 30-40 percent, decreases the labor expenditures by 10-15 percent, while the production of items can be organized on the basis of enterprises of large-panel housing construction and reinforced concrete structural members.

The introduction in construction of structural members of series 1.220.1-2 at practically all the territorial organizations, including the organizations located in zones with great seismic activity, is envisaged by the plan of organizational and technical measures of the ministry for 1982-1985.

During the 10th Five-Year Plan the obsolete architectural layout and design decisions were revised by the ministry and starting in 1981 the use of industrial precast reinforced concrete structural members in agricultural production projects was practically eliminated. The two most economical design arrangements with respect to materials-intensiveness and labor intensity: the beam-pillar and the frame-panel, were adopted for extensive introduction and are being produced everywhere, which will provide an increase of the level of prefabricated construction by 1985 to 86 percent. The mass introduction of pile columns and foundations in rammed pits has begun, large-panel partitions made of asbestos cement extrusion-molded slabs are being used. Housing construction in the countryside is also being changed over to an industrial basis, first of all by the maximum utilization of the reserves of urban house building combines on the basis of series 90 and 121, as well as the development of the production of the parts of houses of the farmstead type.

The development of prefabricated modular houses of the farmstead type is a step forward in the solution of the problem of industrializing individual housing construction in the countryside. The design decisions and plans of the houses were elaborated by the Vladimir Territorial Administration of Construction in cooperation with scientists of Vladimir Polytechnical Institute and specialists of the All-Union State Institute for the Planning of Industrial Buildings and Structures for Agriculture. The arrangement of apartments on one and two levels is envisaged by the designs.

The prefabricated room units with an area of 17.6 m<sup>2</sup>, which have been readied under plant conditions for final painting, are transported to the construction site (see the photograph [photo not reproduced]) and are assembled into a house (see the figure on the second page of the cover [figure not reproduced]) by a link of installers consisting of five people, including the operator of a KS-647 crane. The erection of a building with two apartments, for example, takes a week. The change-over to the industrial method of building houses of the farmstead type will make it possible to expedite the solution of the housing problem in the countryside and will serve as a worthy contribution to the fulfillment of the USSR Food Program, which was approved by the May (1982) CPSU Central Committee Plenum.

The quickest possible introduction of the developments of today meets the requirements of the leading level of production of tomorrow. The experience of the best collectives of our ministry shows that the more attention that is devoted to the link of science with production, the more appreciable the gains in this matter are. Convincing evidence of the steadily increasing role of scientific research organizations in the improvement of the technical and economic indicators of the production activity of our enterprises, especially by means of the introduction of the achievements of science in practice, is their creative cooperation, which is increasing from year to year, with the territorial subdivisions of the ministry by the conclusion of long-term contracts.

Under the conditions of great political and labor enthusiasm the collectives of the organizations subordinate to the USSR Ministry of Construction are working persistently on the implementation of the decisions of the 26th CPSU Congress, the November (1981) and May (1982) CPSU Central Committee Plenums and the instructions and recommendations, which were made by L. I. Brezhnev at the 17th Congress of Trade Unions. The large collective of workers and employees of the USSR Ministry of Construction are greeting the 60th anniversary of the formation of the Union of Soviet Socialist Republics with new labor achievements.

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## CONSTRUCTION PLANNING AND ECONOMICS

### MINISTRY CRITICIZED FOR SQUANDERING RESOURCES

Moscow MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE in Russian No 10, Oct 82 pp 27-30

[Article N. Gushchin: "Without a Precise Program"]

[Text] In recent years the technical level of capital construction has increased considerably, its material and technical base has been strengthened. One can see this well from the example of the enterprises and organizations of the USSR Ministry of Construction. Suffice it to say that by the beginning of this year they had more than 600 mechanized lines for the production of reinforcing cages, 138 lines of the waste-free welding and cutting of reinforcement bars, 23 sets of dies for the production of embedded fittings, 5 enterprises, which produce particle boards from the scraps of wood processing, and 25 lines of the lengthwise jointing of lumber. The construction projects of the ministry annually receive 150 units for the receipt, mixing and delivery of mortar and 350 units for the heating and feeding to the workplace of bitumen mastics.

It would seem that the high technical equipment should ensure not only an increase of the rate of construction, but also the careful consumption of material resources. However, as the facts show, this is not happening. Last year many construction organizations of the ministry did not fulfill the set assignment on the economy of materials. The excessive consumption of about 130,000 m<sup>2</sup> of glass, 450,000 asbestos cement ties, 11,000 m<sup>2</sup> of linoleum and more than 500,000 m<sup>2</sup> of soft roofing was permitted. The situation is also forming unfavorably this year. Thus, the annual plan of the economy of ferrous metals during the first quarter was fulfilled by only 16.5 percent, cement--17.3 percent, lumber--19.5 percent and boiler and furnace fuel--15.2 percent.

A most important condition of the careful attitude toward the consumption of materials is the improvement of the standards service. As is emphasized in the decree of the CPSU Central Committee and the USSR Council of Ministers on the tightening up of the policy of economy, it is necessary to increase the mobilizing significance of norms and standards, to revise in good time the prevailing rates of the consumption of raw materials and materials and to establish new advanced ones. Unfortunately, in the USSR Ministry of Construction the work in this direction is being carried out poorly. A check of 255 primary contracting organizations showed that in the process of performing construction and installation work the excessive consumption of many physical assets as against the norms is permitted everywhere. As a result last year 55 trusts alone did harm to the national economy in the amount of 2.6 million rubles.

The point is that an economical, careful attitude toward everything that is delivered to the construction projects has still not become the norm everywhere. There are frequently instances when they haul off to the dump suitable reinforcement, brick, glass and structural members with minimal defects. It happens that they erect around the site fences made of expensive reinforced concrete slabs and high-grade boards. All this attests that the ministry is inadequately monitoring the activity of construction collectives and is tolerating mismanagement.

The lack of control frequently gives rise to cases of the grossest violations of state discipline. Some construction trusts and administrations, for example, release funded and critical materials to private people and outside organizations. Such violations are being observed at the Spetsstroy Mekhanizatsiya Trust of the Kalinin Territorial Administration, the Main Administration of Construction in Western Regions and other organizations. As strange as it may be, the squandering of material resources not only is not being stopped, but also is not being condemned. Most often the managers explain their actions by the acute need to exchange some materials for other, more critical ones. And such an explanation is enough not to call to account the people who did not ensure the economical consumption of resources and permitted their squandering.

The unsound practice, when metal, cement, lumber and other materials are written off to the performance of work done in preceding years, has taken root at enterprises and construction organizations. For example, the Smolensk House Building Combine wrote off 76 percent of the total amount of the increase of the cost of materials to projects which had already been built long ago. For example, the apartment house in the microrayon of Shchetkino was accepted by a state commission in December 1980, while the expenditures on it were written off through May of last year. The house building combine of the Main Administration of Housing and Civil Construction of the Ivanovo City Soviet Executive Committee in January of last year performed construction and installation work on the building of an apartment house of the Kokhma Cotton Combine worth 15,900 rubles, while it wrote off materials worth 62,000 rubles, in February--respectively 23,000 and 30,000 rubles. In March work was not performed, but metal, cement and other materials worth 6,000 rubles were written off.

Such an unrestricted handling of resources became possible because large above-standard stocks had accumulated at the construction sites. At the beginning of last year 250 million rubles of them existed, including about 170 million rubles which were not backed with credit by the bank. In the Main Administration of Construction in the Upper Volga Region at the beginning of this year the surpluses of metal exceeded the standard by twofold, the Kaliningradstroy Association--2.7-fold, the Kostroma Territorial Administration of Construction--3.6-fold. As a whole for the ministry the surpluses of cast iron and welded pipe and structural glass were two- to threefold greater than they were supposed to be.

The question arises: Where do such enormous above-standard stocks come from?

It turns out that the point is that the designers when drawing up the technical specifications frequently incorporate such a consumption of materials, which greatly exceeds the standard consumption. The construction workers themselves often violate planning and contractual discipline and do not cope with the assigned program of contracting work. Meanwhile, the materials and structural members are delivered long before they are used.

Trust No 68 of the Main Administration of Construction in Western Regions, for example, for the construction of a dormitory back in June of last year received 410 m<sup>2</sup> of window blocks, 940 m<sup>2</sup> of door blocks and 250 m<sup>3</sup> of reinforced concrete items. All this was needed only during the second quarter of this year. Considerable reserves of precast reinforced concrete were created without consideration of the actual need at Kalininstroy Trust No 1 of the Kalinin Territorial Administration of Construction.

Another means of the formation of surplus stocks is the incomplete delivery of materials and structural components by one's own industrial enterprises. For this reason old stocks of precast reinforced concrete structural members worth 1.8 million rubles formed at seven trusts of the Main Administration of Construction in Western Regions. At some construction organizations a large amount of the surplus and unnecessary physical assets is stored for years in warehouses. Thus, at the base of the administration for the supply of complete sets of technological production equipment of Trust No 49 of the Uzbek SSR Ministry of Construction 435 m<sup>3</sup> of precast reinforced concrete structural members have been lying around for 12-14 years. They became unfit for use long ago and cannot be used as load-carrying structural members.

For the purposes of the most efficient use of resources the USSR Ministry of Construction annually establishes for its subordinate enterprises and organizations assignments on the commitment to the economic turnover of above-standard reserves of commodity stocks. However, these assignments are not being fulfilled. Moreover, some managers are concealing from control organs the real situation with the supply of construction projects with materials. On 1 January of this year at 148 enterprises and organizations there were more than 3,000 tons of rolled ferrous metal products, over 6,000 tons of cement and 3,000 m<sup>3</sup> of lumber, which had not been recorded in a single document.

No wonder that during the years of the past five-year plan the ministry did not achieve the stipulated decrease of production stocks. Instead of this they increased by tens of millions of rubles, although the amount of construction and installation work did not increase substantially.

It is well known that the saving of material resources in many ways depends on the quality of the work being performed. The careful consumption of metal, cement, lumber, glass and other materials is being achieved wherever it is not necessary to finish off or alter anything. And, on the contrary, carelessness in the performance of work, violations of the order of priority and obvious defective work increase the consumption. Unfortunately, in the USSR Ministry of Construction there are many trusts and main administrations, at which the drive for quality has not yet become a topic of concern of the managers, party and public organizations and all the labor collectives.

Let us take, for example, the house building combine of the Main Administration of Housing and Civil Construction of the Ulyanovsk City Soviet Executive Committee. Here they have taken it as a rule to carry out the installation of the electrical lighting fixtures after all the rooms have been wallpapered. Defects are frequently found in them after the installation of the water supply system. As a result, last year alone the combine overexpended materials worth 20,000 rubles for the elimination of the flaws. Construction Administration No 101 of



Trust No 46 of the Main Administration of Construction in Western Regions erected the House of Pioneers and School Children in the city of Kirishi. The brickwork was performed with a violation of the technology, in places it had to be redone, for which 152,000 bricks in addition to the norm were used.

Thus, the lack of a proper drive for the high quality of construction and installation work leads to large material losses. During the first year of the 11th Five-Year Plan alone as a whole for the ministry they came to about 2.5 million rubles.

The development and introduction of the most advanced technology and the decrease of the materials-intensiveness of construction should promote the economical and efficient use of material resources. As the checks showed, in this respect not everything is fine in the USSR Ministry of Construction. For example, the quality of concrete mixes increases greatly, if plasticizers are added to them. Here 10-15 percent of the cement is saved. But such a method of preparing concrete mixes is being introduced slowly. Given their annual consumption of about 20 million m<sup>3</sup>, only a little more than 4 million m<sup>3</sup> are being produced with the use of plasticizers.

Other innovations, which promote the saving of materials, are also being introduced slowly. For example, industrial partitions made of plaster board in production and laboratory facilities, laminated wood structural members. Only 57 percent of the total amount of large-panel apartment houses are being built in accordance with standard designs of new series. As a result considerable losses of metal are being permitted.

The excessive consumption of resources is being caused by the replacement of some materials with other, more expensive ones. It is said that the construction workers are frequently forced to do this because the suppliers, in violating the contractual obligations, are delivering not what is stipulated by the plans. Indeed, enterprises of the metallurgical industry, for example, frequently provide rolled metal products of the second class instead of the third class and reluctantly roll some sections with a diameter of 16, 18 and 20 mm. In order not to upset the deadline of the placement of projects into operation, the construction workers agree to inefficient substitutions. It has been calculated that if they were to receive metal in the assortment which is suggested in accordance with the plans, its consumption would be reduced by 5-6 percent.

But such substitutions, which are in no way justified, are also being permitted in the USSR Ministry of Construction. For example, the renovation of one of the sewing factors of the Volga-Vyatka Economic Region called for the laying of linoleum floors. However, Trust No 9 of the Main Administration of Construction in Volga-Vyatka contrary to the plan made them from parquet, the cost of which is twofold greater. As a result the expenditures on materials increased by more than 90,000 rubles.

One would like to know whether parquet floors are so necessary in a sewing factory? For linoleum is not only cheaper, but also much more practical: a wipe with a damp rag and it is clean. Parquet requires special care, which it is not that easy to organize.



The careful consumption of material resources in many ways depends on the degree of organization of the construction and installation work. As experience shows, the brigade contract method has become a genuine school of management. Today tens of thousands of brigades at the construction projects of power engineering, the chemical industry and machine building are using it. At the sites, where the followers of N. A. Zlobin work, order prevails, discarded materials are not visible. This is quite understandable. The saving of material and technical resources, fuel and electric power is one of the main points of the contracts concluded with the administration.

As for the USSR Ministry of Construction, the organization of production and labor by this advanced method leaves much to be desired. Last year for the ministry as a whole only 48 percent of the total number of brigades worked on the basis of the brigade contract. They performed approximately 49 percent of the total amount of construction and installation work. But in some organizations this indicator is much lower. In the Kalinin and Mari Territorial Administrations of Construction, for example, not more than 38 percent of the brigades have changed over to the brigade contract.

The USSR Ministry of Construction has elaborated the special program "The Contract." It envisages to increase by the end of the five-year plan the proportion of the operations, which are performed by the brigade contract method, to 60 percent. This, of course, is insufficient.

The organization of the processing of rolled metal products requires improvement. At present at some territorial administrations instead of centralized processing the processing of metal is performed at numerous subsidiary industrial enterprises, which are carried on the balance sheet of construction organizations. Meanwhile the concentration of rolled metal products at a single place makes it possible to build large shops for their preparation for consumption, affords an opportunity to shift resources and decreases the number of production personnel.

The Interdepartmental Commission for the Economy and Efficient Use of Material Resources indicated to the ministry all the enumerated shortcomings. Taking into account the availability at the organizations of the USSR Ministry of Construction of a large quantity of above-standard reserves of commodity stocks, the commission ordered USSR Gosplan to decrease the stocks of rolled ferrous metal products by 10,600 tons, cement--by 50,000 tons, and lumber--by 15,000 m<sup>3</sup>. Fines were levied against the enterprises and construction organizations which permitted the sale on the side or the use not for the immediate purpose of material resources.

It is legitimate to ask: For what reasons are the resources allocated to the ministry being used inefficiently, why did the squandering of materials become possible?

In answering this question, A. A. Leyrikh, chief of the Main Technical Administration of the USSR Ministry of Construction, cited objective causes which are checking the work on the economy and efficient use of material resources. He believes that significant organizational measures have been implemented in the ministry: departments for the economical consumption of material and technical resources and design decisions and a permanent commission for the monitoring of the economical consumption of material, energy and fuel resources have been created. Many technical innovations have been or are being introduced at the construction sites.

All this is correct. However, the taken steps so far have not yielded the proper economic impact. To this day in many organizations of the ministry they are treating the consumption of physical assets not in a practical way.

At the industrial enterprises of the ministry, for example, the proper monitoring of the proportioning of the concrete mix and the working order of the measuring equipment is lacking. As a result the ultimate strength of the concrete is overstated as against the design brand. Instances of the sale of critical materials on the side, exchanges and other illegal actions are occurring.

At the construction sites the procedure of storing materials and structural members, which is stipulated by the plans of the organization of the work, is not being observed, there are no passages for transport and equipment. All this is leading to losses of a considerable portion of the material resources. After the completion of the construction of literally every project massive Saturdays are organized for the hauling away of the excessively delivered, split and broken reinforced concrete structural members, pipe, reinforcement and rolled metal products.

At many plants of reinforced concrete structural members the pool of metal accessories is in a state of neglect. The forms have inadmissible bucklings of the side elements and do not close tightly. This leads to the decrease of the quality of items and of their plant readiness and to production with large positive tolerances.

It should especially be noted that at the enterprises the drive for the saving of thermal energy and electric power is being conducted poorly. The automatic equipment of the heat treatment of structural members is not being used, the water seals of the chambers do not work, the lids are bent, the chambers steam. At the Mari and Smolensk Territorial Administrations of Construction the matter has gone so far that due to the increased moisture level in the shops the finished items fail.

It is possible to continue the list of examples of an improvident attitude toward the matter. They all testify that even the most careful elaboration of measures in the form of decisions of a collegium, orders and instructions will remain on paper, if there is no precise program of action on the implementation of what has been outlined. And the USSR Ministry of Construction has precisely no such a program.

The Main Technical Administration of the ministry, for example, in 1.5 years has not elaborated norms for the centralized transfer of rolled metal products to subcontracting organizations for installation, ventilation and several other types of work. In a number of territorial organizations the services of the chief engineer and the trusts of Orgtekhstroy, which are subordinate to them, are poorly carrying out the expert appraisal of the planning estimates. They are continuing to coordinate and to accept for execution the plans of industrial and agricultural enterprises, public and residential buildings, in which a greater consumption of basic construction materials is stipulated than is established by the prevailing sectorial norms and is confirmed by the control indicators.

In order to eliminate the existing shortcomings, the USSR Ministry of Construction should set up the constant monitoring of the fulfillment of the adopted decisions and organizational and technical measures, should implement effective measures on the reduction of the above-standard surpluses at subordinate construction

organizations and enterprises, should eliminate the unproductive losses of metal, cement and other materials and should introduce everywhere the waste-free technology of the production of parts, items and structural members. But the main thing is to react promptly and keenly to displays of mismanagement, violations of the established rates of the expenditure and consumption of resources, flaws in work and the waste of physical assets.

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## CONSTRUCTION PLANNING AND ECONOMICS

### PARTY OFFICIAL URGES MATERIALS CONSERVATION

Moscow MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE in Russian No 10, Oct 82 pp 15-21

[Article by I. Dmitriyev, chief of the Construction Department of the CPSU Central Committee: "Capital Construction and the Efficient Consumption of Materials"]

[Text] Capital construction as one of the leading sectors of the national economy consumes an enormous amount of material, fuel, energy and other resources. Suffice it to say that more than 126 million tons of cement, 250 million m<sup>3</sup> of concrete and reinforced concrete, about 260 million m<sup>2</sup> of window glass, 40 million tons of rolled metal products, more than 100 million m<sup>3</sup> of lumber and a large amount of other materials and items worth a total amount of nearly 50 billion rubles are allocated annually for its needs.

Of course, with such a scale each percent saving of material resources in construction turns for the state per year into a round sum of approximately 500 million rubles. That is why the considerate, careful attitude of construction workers toward public property is of enormous importance. It must not be permitted that even a negligible portion of what is created by the labor of the Soviet people would be lost irretrievably, without benefit at the construction sites in the process of production, transportation and storage.

The importance of this problem for the entire national economy and specific means of solving it are specified in the decree of the CPSU Central Committee and the USSR Council of Ministers "On the Stepping Up of the Work on the Economy and Efficient Use of Raw Material, Fuel, Energy and Other Material Resources." In it, in particular, it is stated that every Soviet individual should actively participate in the drive for economy and thrift and should make his specific contribution to this national cause.

More than a year has already passed since the promulgation of the decree. Today it is possible to tally some results of its fulfillment and to analyze what USSR Gos-snab, USSR Gosstroy, the ministries and departments, the collectives of enterprises of construction materials and the construction industry and construction, installation and planning organizations have done in the time that has passed.

It should be said that during this time the organizing work has been stepped up. Party organizations have begun to devote more attention to the economy and efficient use of resources. Questions of economy are being discussed at the meetings of the

collegia of ministries and departments. They have specified and are implementing specific measures and have issued the corresponding orders and other instructional documents. Interdepartmental and departmental commissions have been formed. All this is yielding positive results. At many construction organizations the careful treatment of physical assets is a subject of constant concern of all the labor collectives.

Meanwhile it has to be admitted that the proper change in the improvement of the use of material resources as a whole has not occurred. Engineering forces are insufficiently aimed at the solution of this important problem, the experience of production innovators and the initiative of leading collectives are being poorly encouraged and disseminated. In some ministries and departments and territorial organs of USSR Gosstnab the necessary specificity and efficiency have not yet been lent to the work on economy and thrift, at times a sociable, routine approach to this important matter is permitted. As a result at the construction projects considerable losses of construction materials, structural components and parts are also occurring, much time and much capital are being spent on the elimination of construction flaws, the errors of designers and other consequences of obvious and concealed mismanagement.

Thus, the total losses of cement during its production, transportation and consumption come to approximately 12 percent of the total volume of output. Here the direct losses alone in the case of transportation in nonspecialized vehicles, from repeated transfers and storage in unadapted facilities come to 8 million tons. A significant excessive consumption of cement is occurring due to the use of poor quality concrete aggregates, low standards of production and other shortcomings. For these reasons last year, for example, the Odessapromstroy Combine of the USSR Ministry of Industrial Construction consumed 20 percent too much cement, the enterprises of the Main Administration of Construction in the Altay of the USSR Ministry of Construction--18 percent, the Nakhodka Plant of Reinforced Concrete Structural Members of the Ministry of Transport Construction--21 percent.

Large losses of reinforcing steel and wire, lumber, window glass, brick, mortars, varnishes and paints are permitted annually. First of all the construction ministries and departments, as well as the territorial organs of USSR Gosstnab, which are called upon to carry out the strict monitoring of the use of material resources in construction, are to blame for this.

In a speech at the 19th Komsomol Congress Comrade L. I. Brezhnev identified the strictest economy everywhere and in everything as the most important economic and political task which the party is now posing for all the people. "We," he said, "have vast resources. But the trouble is that frequently machines and metal, grain and raw materials, materials and fuel are used insufficiently wisely, carelessly, not efficiently. It cannot continue this way further. If we are able to rid ourselves of this sin, the country will become much richer, while the people will live better."

In capital construction there are considerable reserves of the economy of material, fuel and energy resources. First of all it is necessary to straighten out things with the storage, accounting and consumption of everything that is delivered to the construction projects. For it is no secret that frequently it is possible to see there shaped plating, pipe and rolled metal products, which have been twisted by

a bulldozer, structural components covered with rust due to untimely painting, split reinforced concrete items, broken brick, discarded reinforcement and electrodes. A form made from high-grade boards after a single concreting often is burned or hauled away with garbage to the dump.

These facts testify that a wasteful attitude toward materials is permitted at many construction organizations. Economic work does not lead to a real saving of metal, lumber, cement, glass, fuel and other physical assets. It is necessary to put an end to such shortcomings. It should be seen to that the efforts of economic managers and party and public organizations would be aimed at the involvement of each participant in construction in the movement for economy and thrift. The review of the standards of production at construction projects, which is conducted by the Central Committee of the Construction and Building Materials Industry Workers Union, should also promote this.

Particular attention should be directed to the economical consumption of metal. For 12 million tons of reinforcing steel are consumed annually just for the production of reinforced concrete structural members. For example, the changeover to the production of embedded fittings by the stamping method makes it possible to decrease its consumption by 20-25 percent. Scientists of the TsNIIproyektstal'konstruktsiya, using the results of long-term observances of the performance of structural members and the actual properties of steel, gave a new classification of buildings and structures in accordance with the degree of their responsibility and stated more precisely the reliability indices and the safety factors. Theoretical studies, which make it possible to make stricter the rates of consumption of metal for the production of steel structural members and by means to this to decrease their weight by 10 percent, were conducted.

Each year more than 5 million m<sup>3</sup> of piles are consumed in construction. Just the changeover everywhere to pipes without lateral reinforcement will make it possible to save more than 100,000 tons of metal. A large amount of defective and substandard reinforced concrete items is piling up at construction projects and plants of precast reinforced concrete. If their crushing and the removal of the reinforcement are organized, it is possible to reuse several tens of thousands of tons of metal. At the same time several million m<sup>3</sup> of crushed stone will be obtained. Unfortunately, such a process has been organized only at enterprises of Moscow and the USSR Ministry of Industrial Construction.

Another means of saving metal is the use of plastic, glass and asbestos cement pipe instead of metal pipe. As experience shows, this provides a great advantage. During the years of the 10th Five-Year Plan and last year 45,000 km of glass pipe were installed. As a result 300,000 tons of metal pipe, including 120,000 tons of very scarce pipe made of stainless steel and nonferrous metals, were saved. The economic impact exceeded 500 million rubles.

The changeover to new methods of the production of reinforced concrete structural members is also of great importance. In the past 2 years three plants for the production of hollow slabs by the extrusion method were built in Sverdlovsk, Bashkiria and Belorussia. They consume 15-20 percent less reinforcing steel than other enterprises. In the case of this technology metal forms and accessories are not at all required. Labor productivity is increased by fivefold.

The designing and production of steel structural members should promote the careful consumption of metal. It is a question of the changeover to the mass production of more advanced structural members of production buildings with the use of steels of increased and high strength, thin roll-formed sections and light-weight metal structural members. It is necessary to increase the production volume of wall panels like the sandwich and roofing monopanels made of galvanized shaped steel sheet.

The economy of other construction materials is also of great importance. For example, during the 11th Five-Year Plan it is envisaged to decrease the consumption of cement by 5-7 percent.

The increase of the use of industrial waste products for the production of construction materials and items should play a significant role. For example, it is possible to obtain from the ash and cinders of thermal electric power stations raw materials for the production of cement, silica brick and cellular and dense autoclave concretes. Metallurgical slags are being used in the production of cement, slag pumice, mineral wool and broken casting material.

It is especially necessary to dwell on the use of gypsum. Of all the materials used in construction it has the lowest power-output ratio. The specific power expenditures per square meter of gypsum partitions are one-third as great as those of brick or reinforced concrete partitions. Moreover, such structural members are lighter and more technologically efficient in the case of production, processing and installation. Items made from gypsum are especially efficient in rural construction. Their use should be expanded everywhere, utilizing for these purposes the enormous amount of waste products of chemical production--phosphogypsum.

Unfortunately, the construction ministries, their territorial organizations and trusts were unprepared to use these materials. For the present only in the Main Administration of Installation and Special Construction Work of the Moscow City Soviet Executive Committee did they appreciate and are they using successfully, for example, gypsum board as industrial partitions. Here the production of elements of the skeleton has been organized, the appropriate tools have been purchased, specialized brigades and links have been created, the necessary documents have been prepared. The subdivisions of the main administration have already erected with a great saving of resources more than 1 million m<sup>2</sup> of gypsum board partitions in industrial and residential buildings.

However, USSR Gostroy is obviously engaging inadequately in the introduction of this efficient material. The matter has gone so far that in the plans on new equipment for the current year there was no place for studies on the use of items made from gypsum.

The questions of the economical use of lumber require close attention. It must be stated frankly: we have not yet learned to save lumber. The check made in 1980 of five construction organizations of the Ukrainian SSR Ministry of Construction of Heavy Industry Enterprises revealed the typical shortcomings: poor storage, the use of unseasoned materials, the unsatisfactory quality and small amounts of the application of preservatives to wood, the squandering of lumber products. All this led last year to the excessive consumption of hundreds of thousands of cubic meters of lumber.

A resolute campaign must be waged against mismanagement in the use of lumber. At the same time the production and use in construction of efficient substitutes for it: waterproof plywood, laminated materials, parquet boards and panels, should be developed rapidly. The initiative locally on the use of wood scraps for the production of arbolite--a valuable wall material--merits every type of support.

The extensive use of scientific developments is of decisive importance in the more efficient use and economy of material resources. A large army of scientists work in construction. The task of local economic and party organs is to utilize their potential more completely. Specific tasks, which are posed by practice, should be set for scientific collectives, the close contact of institutes with production should be organized.

The experience of the Soyuzmetallostroyeniye Association of USSR Gosstroy and the Scientific Research Institute of Foundations and Underground Structures imeni N. M. Gersevanov, which are giving much assistance to production collectives in the additional decrease of the labor expenditures and materials-intensiveness when constructing many projects, is significant. As a result of the joint efforts of scientists and experienced workers a significant saving of material and manpower resources was achieved at the construction site of the nitrogen fertilizer plant in Togliatti, a number of agricultural projects in Vladimir, Pskov and Moscow Oblasts, in the construction of the Oskolskiy Electrometallurgical Combine and other enterprises.

And still it should be emphasized that the scientific organizations of the sector are greatly indebted to the construction workers. They are making too few suggestions which are revolutionizing capital construction, particularly in the theory of structures, structural mechanics and physics. Obviously not enough new, more economical construction structures and materials are being proposed. The data on the actual performance of structure members in constructed buildings and structures are being poorly generalized. But the obtained generalizations can serve not only as a criterion of the evaluation of the prevailing theoretical assumptions. They would make it possible to use the reserves which lie in the use of the not always justified standard safety factors of structural members.

The economy of material resources in many ways depends on the quality of the design developments. Wherever the designers work boldly on the problems facing them on the reduction of the mass of buildings and structures and their materials-intensiveness, the decrease of the cost and labor intensity of construction and the introduction of advanced technological processes and equipment, the construction is carried out in an organized and economical manner and is completed on the date established by the standards. Such giants of modern industry as the Kama Motor Vehicle Plant, Atomash, the Krasnoyarsk Plant of Heavy-Duty Excavators and many other projects can serve as an example.

Domestic and foreign practice of designing and construction shows that the improvement of the technology in industrial production, its implementation and equipment has a decisive influence on the increase of the effectiveness of capital investments and the sharp decrease of the material and labor expenditures in the production and construction which are being developed.



The experience of the leading collectives of designers confirms that the further standardization of the volumetric layout and structural designs of buildings and structures and the efficient standardization of structural members and items should become the main directions in their activity on the improvement of plans and estimates. It is necessary to extend the use of elements and parts of complete plant fabrication of light-weight metal structural members, which are delivered in complete sets, new industrial types of partitions, built-in rooms and types of finishing of buildings. The conveyor assembly and block erection of the floors of production buildings should be introduced even more extensively.

The experience of the planning organizations of Moscow, Leningrad, Kharkov and Novosibirsk, which are working under the motto: "For Each Construction Project a Modern Economical Design!", merits dissemination. They are working in close contact with institutes of the technological type and production workers and are assuming joint socialist obligations which are aimed at the achievement of high end results.

The experiment in the Main Administration of Construction in Western Regions revealed a major reserve of the increase of the effectiveness of capital investments and the economy of material and manpower resources. Here the role of contracting organizations in the improvement of design decisions was increased. A bureau of expert appraisal, which makes an analysis of the correctness and effectiveness of the design decisions made in the approved technical specifications, was created. The construction workers received an opportunity for the display of initiative and creative work, which is aimed at the decrease of the amounts of construction and installation work and the reduction of the consumption of materials and the expenditures of labor.

They adopted the experience of Leningraders in the Main Administration of Housing and Civil Construction of the Moscow City Soviet Executive Committee, the Main Administration of Construction of the Moscow Oblast Soviet Executive Committee, the Main Administration of Construction in the Central Volga Region, the Main Administration of Construction in the Central Urals Region and several other main administrations. As a result the estimated cost of projects decreased by nearly 200 million rubles, 50,000 tons of metal and more than 200,000 m<sup>3</sup> of precast reinforced concrete were saved. This experience should be disseminated everywhere. Their work completely meets the tasks posed in the decree of the CPSU Central Committee and the USSR Council of Ministers on the tightening up of the policy of economy.

The economy and efficient use of fuel and power, of which the enterprises and organizations of the construction industry are large consumers, hold a special place in the set of measures which are aimed at the careful consumption of resources. For example, the cement industry annually consumes more than 22 million tons of process fuel. It would seem that the most serious attention should be devoted here to questions of economy. However, many reserves are still not being utilized. At cement plants the specific consumption of fuel is decreasing slowly. The economical "dry" method of producing cement is being poorly developed. The production lines built for this have serious shortcomings and so far have not achieved the design indicators.

Much can be achieved by the industrial introduction of the low temperature salt technology, the production of cements, which do not require or shorten considerably

the time of the steam curing of items, and many other energy-saving production processes. The mechanical dehydration of slurry should also be introduced more boldly, secondary heat and the heat which is radiated by the shells of furnaces should be used more completely, the moisture content of the slurry should be decreased by means of additives.

The decrease of the specific consumption of fuel is also an important reserve of economy in the production of reinforced concrete. For in the past 5-6 years the energy expenditures here in practice have not decreased and exceed the standard expenditures by nearly twofold. For the present the bulk of the reinforced concrete items are steam cured in imperfect pit chambers, the efficiency of which is only 10-15 percent. The scientific research and planning and design institutions of the sector, rationalizers and inventors should direct their efforts toward the development of more productive and economical heat units.

It is no less important to develop and introduce energy-saving technologies and to expand the production of various chemical additives which make it possible to achieve the intensification of technological processes. It is also possible to obtain a saving of fuel by such methods of the heat treatment of items as electric heating, the use of combustion products for these purposes and other efficient methods.

In recent times the cheaper casting yard method of producing reinforced concrete with its natural curing without steam curing has been groundlessly curtailed. According to the estimate of specialists, it is possible to use this method with a great impact at more than 250 plants of the southern zone. Meanwhile the consumption of thermal energy for the production of precast reinforced concrete at enterprises located in the southern part of the country is frequently greater than at northern enterprises. Thus, at the plants of Moscow, Leningrad and the Latvian SSR 60 kg of conventional fuel are consumed per cubic meter of items, while in Azerbaijan and Armenia 1.5- to 2-fold more is consumed.

Estimates show that with the introduction of elementary accounting and the monitoring of power consumption, the insulation of steam curing chambers everywhere, the extensive use of efficient methods of the heating of items, natural heat and other measures, which are within the reach of every plant, the consumption of energy for the production of reinforced concrete can be reduced considerably without special capital expenditures and a saving of several million tons of fuel a year can be obtained. USSR Gosstroy, the construction ministries, main administrations and enterprises are called upon to practically solve these technical problems.

Considerable reserves of the saving of fuel and energy resources exist in the glass, ceramics and sanitary engineering industries and in the production of wall, roofing, insulating and soundproofing materials. Energy-saving technological processes must be developed and introduced, the mass insulating of roasting and drying units must be carried out, secondary heat, chemical additives, cinders, ashes and the waste products of other sectors of industry must be utilized on a larger scale, the main and auxiliary processes must be mechanized and automated.

The decrease of the norms of designing, which concern the thermal insulation of buildings and structures, should become a significant means of the economy of fuel. For about 30 percent of all the solid and gaseous fuel produced in the country are

consumed for their heating. Unfortunately, even now the groundless passion for the installation of large window openings, the use without due need of skylights and the fitting of single-pane windows are occurring in the practice of industrial construction. Due to this alone the heat losses come to 3 million tons of conventional fuel a year.

The fitting of windows and balcony doors with three panes of glass is the most economical. This decreases by one-third the losses of heat through them. It is also necessary in the regions with severe climatic conditions to change over the plants of reinforced concrete items to the production of three-ply panels with an effective warmth-keeping jacket. Finally, all buildings should be prepared in earnest for winter, all heat leaks should be eliminated.

The implementation of the measures outlined in the decree of the CPSU Central Committee and the USSR Council of Ministers on the tightening up of the policy of economy in many ways depends on USSR Gosstnab and its territorial organs. Unfortunately, significant shortcomings exist in their activity. The practice of the considerable underfulfillment of the plans of deliveries of materials for capital construction, for example, has not been eliminated. Thus, last year the 10 main construction ministries failed to receive more than 1.5 million tons of rolled metal products, about 600,000 tons of steel pipe, more than 400,000 tons of cement and approximately 4.6 million m<sup>3</sup> of commercial lumber.

Construction organizations and enterprises of the construction industry are receiving materials, especially rolled metal production, irregularly and not in the assortment which was ordered. To avoid the upsetting of the assignments on the placement of projects into operation and the halting of construction and installation work the contracting organizations are forced to use the available heavier grades of rolled metal products and less efficient brands of steel than is called for by the plans. This leads to unproductive expenditures of metal and other materials.

**Large-Panel House** Building Plant No 1 of the Minsk Minstroy Association last year received the first batch of steel of class A-III with a diameter of 10 mm only in May. The next deliveries were in July and October. Here 40 percent of this steel was replaced by steel of a lower class or a larger diameter. The suppliers failed to supply the enterprise with 60 percent of the wire with a diameter of 3 mm and 25 percent of the wire with a diameter of 5 mm. In turn nearly twofold more wire of a larger diameter was delivered than was supposed to be.

As a result of the forced substitutions the unproductive consumption of metal at the plant came to more than 8 percent. At other enterprises this figure is considerably higher. For example, at the Sukhumi House Building Combine of the Georgian SSR Ministry of Construction it is 16.3 percent, the Fergana House Building Combine of the Uzbek SSR Ministry of Construction--11.6 percent, the Kharkov House Building Combine of the Ukrainian SSR Ministry of Industrial Construction--17.4 percent. According to a preliminary estimate 4-4.5 kg more reinforcing steel are being consumed per cubic meter of reinforced concrete than is suggested according to the standard.

Very often the supply enterprises upset the dates of deliveries and make them not in accordance with the products list which is specified by the orders. In such instances the organs of USSR Gosstnab frequently remain as if aloof and do not bear

responsibility to the consumers. This is hardly correct. In our opinion, definite responsibility for the complete fulfillment of the established plans of deliveries to producing enterprises should be imposed on supply organs. This will promote the timely and complete supply of capital construction with material resources.

The decree of the CPSU Central Committee and the USSR Council of Ministers on the improvement of the economic mechanism obligated USSR Gosstnab to complete in 1981 the changeover of the construction projects, which are included in the state plan of capital construction, to the complete supply of materials through territorial organs in accordance with the orders of construction and installation organizations in conformity with their needs, which are specified by the plans and estimated. However, so far this task has not been accomplished. On 1 January of this year only 26 construction organizations had been changed over to the new system of supply. They perform only 8.6 percent of the total amount of construction and installation work which is being carried out at the expense of state capital investments.

Using the gained experience, USSR Gosstnab should expedite the changeover of all construction organizations to supply in accordance with the needs which are specified by the plans and estimates. This will promote the economical and efficient use of material resources in capital construction.

Another sore subject, the settlement of which USSR Gosstnab should take into its hands, is the transportation of materials. The need has arisen to introduce the strictest schedule of the transportation via railroad of such freight as reinforced concrete (except special-purpose reinforced concrete), brick, rock and other materials. Their long-distance transportation is frequently not a consequence of a shortage, but a result of departmentalism, the costs of planning and the lack of control on the part of the appropriate organs. It must be seen to that each republic, oblast and rayon of concentrated construction would meet its own need as much as possible, by producing locally brick, reinforced concrete and porous aggregates and by using extensively for these purposes the small deposits of raw materials, which exist everywhere, the waste products and byproducts of other sectors of industry.

An important task of USSR Gosstnab and its territorial organs is the monitoring of the quality of the rates of consumption of resources, which are used by ministries and departments, associations, enterprises and organizations, and the observance of the rates which are approved centrally. A resolute campaign should be waged against all kinds of waste, overstated rates of consumption should be revealed and steps should be taken on their immediate revision. Here it is necessary be guided by the fact that the CPSU Central Committee and the USSR Council of Ministers obligated the ministries and departments of the USSR and the councils of ministers of the union republics to ensure the great scientific and technical soundness of the approved rates and the assignments on their decrease.

The construction workers also have the right to expect direct assistance in the saving of materials from the workers of the statewide system of material and technical supply. Opportunities for this exist. Today when finishing housing, for example, the tastes and desires of the future residents are not taken into account. Therefore, after obtaining an apartment, the new resident begins to remodel it in conformity with his own needs and possibilities. The color of the finished rooms is changed, a part of the bathroom, the toilet and the kitchen is tiled with

colored tile instead of white glazed tile, pile floorings are laid over the already finished floors, the sanitary engineering, gas and electric lines, which are adapted to the acquired set of kitchen furniture, are moved.

Statistics show that more than 70 percent of the new residents change the wallpaper. Practically all the people moving into new apartments install their own locks on the entrances, while throwing away the ones installed by the construction workers. This turns into a loss for the state of several million rubles a year. It is possible to avoid it only by the joint efforts of the construction workers and the workers of the organs of USSR Gosstnab. Just initiative and persistence in the search for new forms of their cooperation in the efficient use of construction materials and items are needed.

Many years of practice have convincingly shown that the brigade contract is the main reserve of the increase of labor productivity and the economy of resources in local collectives. Therefore it is necessary to create purposefully and everywhere the conditions for the dissemination of this advanced form of the organization of labor on the basis of the increase of the level of engineering preparation and the supply of complete sets of technological production equipment.

The organizations, which are ensuring the changeover to the planning of material and technical resources and the supply of complete sets directly to the brigade, are achieving great production results. Here annual plans of construction and installation work and the supply of complete sets of technological production equipment with a breakdown by quarters, months, 10-day periods and days are being set for the brigades. On the basis of the drawn-up schedules the structural members, parts, items and materials are delivered in the necessary quantities to the work zone of the brigade. The number of transfers of the materials decreases, their storing improves, all the waste products are used as much as possible, since each worker is interested in this.

The drive for economy and thrift should become a priority matter of those who manage construction and of those who work directly at the construction sites, enterprises and planning institutes. Party organizations should actively join in this work. The duty of the communists is to explain to each construction worker that the tightening up of the policy of economy is not a simple task, its accomplishment requires systematic and purposeful efforts. It is necessary to devote the main attention to the cultivation among people of lofty consciousness and a truly practical attitude toward resources. The careful, assiduous attitude of each person toward public property should become not so much an obligation and duty as a habit, a norm of behavior.

Questions of economy should be periodically submitted for discussion to the workers' meetings in brigades, sections, administrations, shifts, enterprises, institutes and other organizations. It is necessary for the public to wage a resolute campaign against slipshod workers, sloppy people and absentees. Not one violation should go unnoticed, so that no one would be able to escape responsibility for a committed unseemly action, a flaw in work, additions to job authorizations and the squandering of materials. It is no less important for the conscientious, thrifty worker to always be properly commended and supported and for his experience to become accessible to others.

It is necessary to mobilize the engineering and technical personnel and the administrative staff of trusts, main administrations, associations, ministries and departments for the performance of concrete organizing work on economy and thrift.

It is expedient to begin the establishment of order in the consumption of material resources with the economic managers. And a broad field of activity exists here for party organizations.

The recently held All-Union Applied Science Conference on the Economy of Material Resources in Construction emphasized that the mass organizational work in labor collectives should be aimed at the further development of socialist competition for economy and thrift, the increase of its effectiveness and the development of an intolerant attitude toward cases of mismanagement and unproductive losses, the production of poor quality products and waste. The matter should be organized so that every enterprise and organization would draw up and implement comprehensive programs of measures, which ensure the practical accomplishment of the tasks on economy in construction.

Our country is living in an atmosphere of great political and labor enthusiasm, while implementing the historic decisions of the 26th CPSU Congress. The national socialist competition for a worthy greeting of the 60th anniversary of the formation of the USSR is increasing in scope. All the Soviet people are working intensively on the fulfillment of the assumed obligations on the early completion of the assignments of the second year of the five-year plan. The army of many millions of construction workers is actively participating in this constructive work. The construction workers perceived as their immediate concern the decree of the CPSU Central Committee and the USSR Council of Ministers "On the Stepping Up of the Work on the Economy and Efficient Use of Raw Material, Fuel, Energy and Other Material Resources." They are fully resolved to make their own concrete contribution to this matter.

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## CONSTRUCTION PLANNING AND ECONOMICS

### CONSTRUCTION PLAN, RESOURCES EQUILIBRIUM URGED

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[Article by Doctor of Economic Sciences A. Mitrofanov, director of the Scientific Research Institute of Economics of Construction of the USSR State Committee for Construction Affairs, and Doctor of Economic Sciences V. Spektor, chief of a department of the Scientific Research Institute of Economics of Construction of the USSR State Committee for Construction Affairs (Moscow): "The Balance of the Plans and the Management of Resources in Construction"]

[Text] In the decree of the CPSU Central Committee and the USSR Council of Ministers on the tightening up of the policy of economy the task is posed to improve radically all the work on the economy and efficient use of raw materials, materials, fuel and energy in all the links of the national economy. It is indicated that the scientific, technical and structure policy, the policy of capital investments, the system of management, planning and stimulation and the initiative of labor collectives should be aimed at this. In light of these requirements the problem of the balance of the plans of capital construction with material and technical resources and the management of these resources in the process of fulfilling the plans is especially urgent. This is explained, in our opinion, by three circumstances: by the tasks which face capital construction during the current five-year plan, the formed state of affairs in construction in preceding years and the multi-level nature and extreme complexity of the problem itself.

Capital construction is one of the decisive sections of the 11th Five-Year Plan. That is how Comrade L. I. Brezhnev defined its importance at the November (1981) CPSU Central Committee Plenum. A key role is also assigned to capital construction in the implementation of the USSR Food Program, which was approved by the May (1982) CPSU Central Committee Plenum. In the program and the decrees on its implementation, which were adopted by the CPSU Central Committee and the USSR Council of Ministers, the priority directions of capital investments in the development of the sectors and works of the agro-industrial complex are clearly specified and the need for the implementation of measures on the introduction in agriculture of the standard method of the planning of capital investments and expenditures of basic material resources is indicated. The construction projects of the agro-industrial complex will be regarded as the most important shock work construction projects of the country.

The achievements of capital construction are well known and indisputable. At the same time, owing to a large number of reasons, many shortcomings also exist, the



most important of which are the excessive stepping up of the construction plans, the inclusion in them of a groundlessly large number of construction jobs and projects as compared with the existing potentials. As a result there are the imbalance of the plans with material and technical resources and their extreme dispersal among numerous projects. For example, during the 10th Five-Year Plan in some construction ministries the imbalance of the plans for rolled ferrous metal products came to 4 to 10 percent, cement--2 to 6 percent, some types of pipe--up to 30 percent.

It is clear that under these conditions the completion of the changeover to intensive methods of management is an impracticable task. All this testifies that it is necessary to begin the creation of the proper order in the material and technical supply of construction, the assurance of the strict and stable balance of the plans with respect to resources and the creation thereby of the necessary conditions for the fulfillment of the plans under the optimum or standard conditions with the sharp reduction of the work front. According to approximate estimates, for this it is necessary to decrease the number of construction jobs and projects in the plan by not less than 1.5-fold and henceforth to observe in the strictest manner all the conditions and demands on the inclusion of the plan of new construction jobs and projects.

The assurance of the strict balance of the plan of capital construction with material and technical resources and, what is no less important, the maintenance of this balance in the process of carrying out the plan are a quite difficult complex problem. It encompasses many questions of the planning work and the system of technical and economic substantiations, the organization and introduction of advanced forms and methods of the supply of construction projects with material and technical resources and the cooperation of the sections of construction. But the only basis of the correct and effectiveness settlement of all these questions is the standard base, that is, the system of scientifically sound norms and standards of the consumption of material and technical resources, which takes into account the achievements of scientific and technical progress.

The standard base of the consumption of material and technical resources in construction, as is known, consists of three types of norms: production, estimated and planning norms. Here namely the latter act as the direct connecting link of the planning calculations with production, and therefore with the direct standard base of the balance of the plan. Hence there follows the important conclusion that all the shortcomings at any stage of the rate setting of resources will find their reflection in the planning norms and through them will have an influence without fail on the balance of the plans.

There is used as the planning norms of the consumption of material and technical resources in construction their specific quantity in physical terms per 1 million rubles of construction and installation work. In recent years this indicator has begun to be subjected to sharp criticism which, in our opinion, is not always valid. This is the average standard, and its special purpose should be limited to the framework of the sector or ministry with allowance made for the structure of the work. For all the lower levers of management it is possible to use this standard only at the early stages of preliminary calculations. It is altogether impermissible for specific construction jobs and projects. Precisely in the case of such an approach all the criticism with reference to it will be constructive and useful



for the matter, since in principle, in our opinion, the determination and substantiation of the need for resources in construction per unit of construction and installation work with allowance made for their specialization are the only possible and correct means of formulating planning standards, which by their nature are average and at the same time progressive values.

At present mainly the elaboration of the balances and the plans of the distribution of material resources for capital construction in accordance with the products list of the state plan of USSR economic and social development and USSR Gosplan is covered by the system of planning norms. A significant portion of such balances and plans, which are drawn up in USSR Gosplan and its organizations, do not yet have a reliable and scientifically sound standard base. The existence of a number of shortcomings is characteristic of the system of planning norms. Thus, the objective rates of consumption of materials per 1 million rubles of the estimated cost of construction and installation work are insufficiently dynamic. A significant number of similar norms are still being used when determining the need of construction.

Due to the inadequate development of the standard base an understated coefficient is used for projects of renovation and retooling. Elaborated on the basis of the average reproduction structure of fixed capital for the national economy, it is used when calculating the average norms for all the fund holders of USSR Gosplan--contracting ministries with a volume of 3-5 billion rubles, which have a proportion of renovation and retooling considerably less than the average, as well as sectorial ministries and departments, in which the proportion of renovation and retooling in the total amount of construction and installation work is considerable greater.

The effective monitoring of the fulfillment of the planning norms on the basis of a comparison with the specific indicators of the actual consumption of materials is not being completely ensured. Established statistical and departmental reporting is lacking with respect to this question. Those comparable estimates, which the main construction ministries make annually according to arbitrary forms in the absence of a uniform methodology, do not make it possible to reveal and analyze the causes of the excessive consumption of resources, which frequently occurs.

A quite high degree of generalization of the objective rates of consumption of materials, which are elaborated on the basis of the total estimated cost of construction and installation work at representative projects without a breakdown by stages and phases of the construction, leads to distortion in the determination of the need at the middle level of management (territorial administrations, main construction administrations, the ministries of construction of the union republics), as well as among the fund holders with a comparatively small annual amount of construction and installation work (less than 200,000-300,000 rubles). The results of the analysis conducted by our institute of the rates of consumption of material resources, which are used when planning supply in the USSR Ministry of Construction and its construction organizations of different levels of management, attest to this. Depending on the annual amount of construction and installation work they were united into three groups: up to 100 million rubles, from 100 to 250 million rubles and from 250 to 500 million rubles. As a whole for the ministry the deviation of the planned average rates from the actual consumption, for example, of rolled metal products is within the range of -0.3 to -1 percent, while for the analyzed organizations of the first group it is from -30 to -20 percent, the second group--from -20 to -8 percent and the third group--from -8 to -5 percent.

The analysis of the formation and use of norms for the drafting of the plans of material and technical supply of different levels of management of construction makes it possible to draw the conclusion that the process of the formation of norms in the union republic ministry is separate from the analogous process at the construction enterprise. The disturbance of the continuity of this process led to the inefficient functioning of the objective norms in the link the republic ministry (main construction administration, the territorial administration)--the union republic ministry of construction.

As a result of these shortcomings the coordination of the need, which is specified in the supply plan in accordance with the norms per 1 million rubles of construction and installation work, with the total need of construction projects, which is calculated by the construction organizations on the basis of the plans and estimates, is still not completely ensured. All this adversely affects the balance sheet coordination of the indicators of the plans of supply and construction work, which is especially manifested in the organizations which have been changed over to supply through the territorial organs of USSR Gosstnab.

For the purposes of eliminating the indicated shortcomings the institute jointly with the planning organizations of the sectorial ministries and departments during the past five-year plan revised the objectives rates of consumption of materials, which were previously in effect, with respect to all sectors and types of production and nonproduction construction. The use of the new rates, which were elaborated on the basis of advanced and the most economical plans, made it possible to save annually 200,000 tons of rolled ferrous metal products, 300,000 tons of cement and 1 million m<sup>3</sup> of lumber.

The drawing up and publication in 1980 of the Collection of Rates of Consumption of All Types of Pipe (SN 526-80) were an important stage of this work. The published new procedural instructions defined clearly the concepts of categories of pipelines subject to the place of their laying, the present list of pipe and the methods of drawing up planning estimates when determining the rates of their consumption.

In the past 2 years the institute has expanded considerably the work on the improvement of the methodology and the regular revision of the prevailing rates on the basis of economical and advanced plans, as well as has begun the development of new rates for the renovation and retooling of operating enterprises. About 200 planning organizations of the sectorial ministries and departments were involved in this. The scientific research and standard work was aimed at the accomplishment of the tasks on the increase of the level of balance of the plans and the economy of material resources, which were posed in the decrees of the CPSU Central Committee and the USSR Council of Ministers on the improvement of the economic mechanism and the tightening up of the policy of economy.

With the participation of the Scientific Research Institute of Planning and Norms attached to USSR Gosplan our institute is engaged in the procedural support of all the stages of the formation of objective norms with the use of mathematical economics methods and computers. Thus, methods of the selection of representative projects for new construction and, what is especially important, expansion, renovation and retooling were drawn up and approved for the first time by USSR Gosstroy and USSR Gosplan. The procedural instructions on the determination of the

indicators of the consumption of materials and items per 1 million rubles of the estimated cost of construction and installation work (per 1,000 m<sup>2</sup> of the adjusted total area of residential buildings) were improved. The methods of the preparation of the base data and the software for the making of automated calculations of the indicators and rates of consumption of materials, which have been introduced in a number of sectorial ministries, were elaborated.

When compiling the collections of rates, which were previously in effect, the representative projects were selected on the basis of expert appraisals. The use of the methods of correlation analysis for the objective evaluation of the technical and economic indicators with a different direction, by which construction projects are characterized, and the determination of the rank and place of each project in the set of representative projects, which are analyzed during the selection, make it possible to elaborate norms on the basis of the basic information, which reflects most completely the advanced know-how of designing and construction. The method of selecting representative projects for renovation and retooling includes the determination of their basic types, which make more precise and develop the statutes of USSR Gosplan and USSR Gosstroy on the assignment of construction projects to different types of the reproduction structure of fixed capital.

For the increase of the scientific soundness and progressiveness of the planned rates of consumption of materials, as well as for the improvement of the methods of their use when determining the need of USSR ministries and departments, territorial construction administrations and republic construction ministries, in our opinion, it is necessary to settle several ripe questions. In particular, it is necessary to elaborate for the highest level of management of construction objective rates of consumption of ferrous metals per 1 million rubles of the estimated cost of construction and installation work, which include rolled ferrous metal products, rails, steel and cast iron pipe, forge work, hardware, sanitary engineering and other items made from ferrous metals. This will also require the development of a special method and basic standard reference information.

The question of the changeover to the elaboration of planned standard indicators of the consumption of materials for the middle level of management of construction on a fundamentally new procedural basis and with the use of computers is also ripe. Thus, it is proposed to formulate the average sectorial and the average standard indicators at the level of the republic ministry, the main construction administration and the territorial administration by the methods of aggregation and modeling on the basis of the information on the amounts of construction and installation work and the need for material resources, which was calculated in accordance with the plans and estimates and was grouped by sectorial and intrasectorial directions on the basis of the entire set of projects being built in the given region. In the case of modeling the factors, which influence the annual change of the specific standard indicators of the consumption of material resources: scientific and technical progress (new design decisions and the use of economical materials, the improvement of the organization and technology of production) and the changes in the structure of construction and installation work, should be taken into account.

In our opinion, the need to broaden somewhat and to give concrete expression to some items of rate setting is also ripe. It would be advisable, for example, in addition to steel, which is adjusted to the conventional mass, to include in the list of materials steel in physical mass by classes, types and economical shapes

of rolled metal products. For the monitoring of the consumption of material resources and the fulfillment of the planning norms in construction ministries it is necessary to establish the procedure and forms of statistical reporting on the actual consumption of materials and the comparison of the specific indicators of this consumption with the average norms, which are established by USSR Gosplan for the ministries and departments which perform construction.

All this, it seems to us, is a necessary condition of the further improvement during the 11th and subsequent five-year plans of the planned rates of consumption of materials in construction.

The most important cause of the shortcomings in material and technical supply is the still incomplete conformity of the prevailing system of the management of the flows of materials to the requirements of the industrial organization and technology of construction work. This leads at times to the inefficient use of the available resources. Materials and items are frequently delivered in incomplete form and require additional modification, sorting, cutting or the elimination of defects. Such operations under the conditions of the construction site cause additional expenditures of labor, materials and assets, which adversely affects the quality of the work being performed and labor productivity, as well as leads to the above-standard consumption of materials and the increase of losses. The shortcomings in supply are checking the mass dissemination of the brigade contract. This is confirmed by the data of the USSR Ministry of Industrial Construction, in which only 10 percent of the contracting brigades receive material resources on time and in complete sets, 42 percent receive them with a delay of 2-3 days, 48 percent receive them with an even greater delay.

The untimely and incomplete delivery of prefabricated structural components, items and materials to projects leads, on the one hand, to relatively large losses of working time (intrashift and full-shift idle times) and to the disturbance of the smoothness of the work and, on the other hand, to considerable above-standard stocks. The data on the actual and standard stocks of basic material resources during the years of the 10th Five-Year Plan in the USSR Ministry of Construction, the USSR Ministry of Industrial Construction, the USSR Ministry of Construction of Heavy Industry Enterprises, the USSR Ministry of Rural Construction and other ministries attest to this. According to the data of the Interdepartmental Commission for the Economy and Efficient Use of Material Resources, even now in many organizations of the USSR Ministry of Construction the stocks of materials considerably exceed the established standards. Thus, in the Main Administration of Construction in the Upper Volga Regions the balances of rolled metal products exceed the standard by 2-fold, in the Main Administration of Construction in the Altay--by 1.9-fold, at the Kaliningradstroy Association--by 2.7-fold. The balances of such materials as cast iron and welded pipe and structural glass for the ministry as a whole exceed the standard by two- to threefold.

The nonfulfillment by enterprises and sectors of the production plan set for them should also be grouped with the causes of the unsatisfactory material and technical supply of construction. As a result they annually fall short in the delivery to the construction organizations of a number of ministries of rolled ferrous metal products by 2-7 percent, cement--up to 1.5 percent and commercial timber--up to 18 percent. There are also shortcomings in the activity of the organs of USSR Gosnab and the contracting ministries. There are many still unsolved problems in the

planning and organization of the production and deliveries of rock products for the production of precast reinforced concrete items and concrete. With respect to just the subdivisions of the USSR Ministry of Construction, which are located on the territory of the RSFSR, 14-18 percent less than the planned annual amount of crushed stone and gravel is delivered annually.

The adoption of the advanced sectorial system of the supply of complete sets of technological production equipment made radical changes in the organization of the supply of construction projects. This system ensures the unity of the production of prefabricated structural components and items in complete sets, the delivery and transportation of all material resources in conformity with the technological parameters and the model of construction work and promotes the most efficient and economical use of resources. As a special form of material and technical supply the system of supply in complete sets is characterized by the fundamentally new forms of management, which are inherent only in it, by a specific set of economic and legal interrelations, as well as by the existence of a special material and technical base, which is the set of means of labor and the technological processes of the warehouse and industrial processing and transportation of material and technical resources.

Given the present highly industrial level of construction the organizational isolation of material supply and its concentration in a single complete system, which is based on the principles of the supply of complete sets of technological production equipment, are objectively necessary. The organs of the management of the supply of complete sets are the most important section of construction on the same level as the other organs which are responsible for the supply of the final product.

The Scientific Research Institute of Economics of Construction of USSR Gosstroy jointly with the leading organizations of the USSR Ministry of Construction, the USSR Ministry of Industrial Construction, the USSR Ministry of Construction of Heavy Industry Enterprises and the Main Administration of Housing and Civil Construction of the Moscow City Soviet Executive Committee is elaborating and taking part in the introduction of new forms and methods of the supply of complete sets through the administrations for the supply of complete sets of technological production equipment, trusts for the supply of complete sets and trusts for the supply of complete sets of industrial equipment. As a result the technical and economic indicators of the activity of these organizations improved. However, the scale and rate of the mass dissemination of this advanced system lag behind the requirements of the intensification of production, which to a certain extent is checking the further increase of the efficiency of construction. The level of the development of the supply of complete sets is insufficiently high in a number of specialized construction ministries. As a whole for the sector it comes to only 46 percent.

Given the overall considerable development of the system of supply of complete sets still far from all the problems have been solved. Thus, for the present the volume of the processing of materials at the bases of the organizations supplying complete sets is not very large. In the cutting of glass it comes in the USSR Ministry of Industrial Construction and the USSR Ministry of Construction to 45 percent of the need, the cutting of wallpaper--55 percent, the cutting and joining of linoleum--43 percent, the preparation of paints, mastics and spackling compounds--80 percent, the production of items made of galvanized iron--45 percent. In the other ministries the level of this work is considerably lower. The development of

containerization and packaging lags behind present requirements. In the USSR Ministry of Construction of Heavy Industry Enterprises, for example, these shipments account for slightly more than 30 percent of the amount of freight being delivered.

In construction the problem of the more efficient use of the material and technical resources being allocated and the sharp decrease of all kinds of losses at all the stages of the delivery of these resources to the construction sites is becoming urgent. The further rapid development of the material and technical base and of advanced forms and methods of the supply of construction projects should play an important role in the solution of this problem. It was proven long ago that it is more profitable to protect and to use economically, without losses the available resources than to build additional capacities for the production of materials and structural components.

The further improvement of the system of the supply of complete sets of technological production equipment in construction ministries and departments should be carried out on the basis of special comprehensive goal programs, in which organizational, technical and economic measures are envisaged. Capital investments and the appropriate material, technical and manpower resources are also necessary for this. The USSR Ministry of Industrial Construction and the USSR Ministry of Construction, which with the participation of our institute elaborated the comprehensive goal programs The Supply of Complete Sets for 1981-1985, acted precisely in this way.

Among the main tasks on the development of this advanced system one should consider the radical improvement of the economic methods of the management of material and technical supply, which is due to the reorganization of the economic mechanism of the management of construction. The plan indicators of the sectorial organizations, which supply complete sets, should characterize the interrelationship of the processes of the supply of complete sets and construction and should have an influence on the fulfillment by construction and installation organizations of the assignments of the state plan on the placement into operation of production capacities and facilities, the production of the output of construction, which is to be marketed, the increase of labor productivity and the profit.

At the institute there was developed for all types of sectorial organizations, which supply complete sets, a new system of plan indicators, which takes into account the organizational, economic and legal peculiarities of their functioning, as well as the periods of planning. The elaboration of approved and estimated plan indicators for all types of expenditures in value and physical units of measurement and the methodological coordination of the technical, economic and calendar planning of the activity of the organizations, which supply complete sets, with similar types of planning of construction organizations and industrial enterprises of the construction industry are envisaged in the proposed system. The approved indicators--the complete deliveries for the planned amounts of contracting work, including for the construction projects being put into operation (the output of construction, which is to be marketed), the volume of deliveries of material resources (output) to consumers in the products list (assortment) in conformity with the issued job authorizations and schedules of the delivery of complete sets--reflect the increased role of the organizations, which supply complete sets, in the production of the finished product, as well as characterize the meeting of the needs of construction and installation organizations by the meeting of the obligations in accordance with contracts. The indicated and other indicators reflect the combination of the



different types of activity of these organizations (industrial production, the supply of complete sets, supply, marketing) and the fact that they have cooperative production relations with construction and installation organizations in the production of the finished product of construction.

The new system of plan indicators is being developed experimentally at several leading organizations which supply complete sets. Among them are the Vostoksibstroy-komplekt Trust of the Main Administration of Construction in East Siberia Regions, the administration for the supply of complete sets of technological production equipment of the Vinnitspromstroy Combine, the Tallinn Trust for the Complete Supply of Industrial Equipment of the Estonian SSR Ministry of Construction, the trust for the supply of complete sets of the Main Administration of Construction and Civil Engineering of the Leningrad City Soviet Executive Committee and the administration for the supply of complete sets of the house building combine of the Main Administration of Construction and Civil Engineering of the Moscow City Soviet Executive Committee.

The system of the complete supply of construction projects with materials through the territorial organs of USSR Gosstnab in accordance with the orders of construction and installation organizations in conformity with their need, which is specified by the plans and estimates, has an influence on the acceleration of the intensification of production. However, so far only a number of construction organizations of the USSR Ministry of Construction of Heavy Industry Enterprises, the USSR Ministry of Industrial Construction, the USSR Ministry of Power and Electrification and the Main Administration of Industrial Construction of the Moscow City Soviet Executive Committee, the amount of work of which comes to only 4.7 billion rubles, have been changed over to such a procedure of supply.

However, given all the positive aspects of this system of supply, significant drawbacks and difficulties, which check to a different extent its use on a more extensive scale, came to light in the process of its introduction. Therefore it is necessary to change over to the organization of guaranteed complete supply through the territorial organs of USSR Gosstnab of not only construction, but also industrial organizations of the construction industry.

It is expedient everywhere to establish economic ties of the territorial organs of USSR Gosstnab with construction enterprises--trusts, combines, associations. Their interrelations should be organized on the basis of economic contracts and mutual material liability.

In the area of improving the planning of the material and technical supply of construction it is first of all necessary that the resources being allocated would ensure the fulfillment of the assignments being set on the placement into operation of production capacities and projects and on the amounts of the output of construction, which is to be marketed. The methods of calculating the need for material resources in accordance with the plans and estimates with the use of computers, which were elaborated and introduced by the Belorussian Ministry of Industrial Construction and the Moldavian Ministry of Construction jointly with our institute, can serve as the basis for this. It is very important to ensure the placement at the disposal of USSR Gosstnab of reserves of materials in the amount of up to 5 percent of the estimated need of the construction organizations which have been changed over to complete supply in accordance with the need specified by the plans and estimates.

The adoption of this system of supply is making new, greater demands on the composition and quality of the planning estimates, as well as on the observance of the deadlines of their elaboration and submittal. The most important of these demands is the elaboration within the planning documents of the data on the need for materials, structural components and parts. Methods of determining in the plans the need for materials for the performance of construction and installation work and the production of structural components and items have been elaborated at our institute, the forms and methodology of the compilation of statements of the need for each basic set of working drawings and of a consolidated statement of the need, which is a part of their complete set for the entire building and structure, have been proposed. As a result changes were made in the system of planning documents for construction (All-Union State Standard 21.109-80), which is making it possible on a new procedural and technical basis to determine the need of construction and installation organizations for materials, structural components and parts for the year being planned, to carry out the preparation of construction work and to draw up the orders and plans of deliveries.

We have examined, in our opinion, the most important and quite ripe questions of the improvement of the planned rates of consumption of material and technical resources in construction, as well as some questions of the organization of advanced forms and methods of the supply of construction projects with these resources. The practical accomplishment of the examined questions, in our opinion, will make it possible to increase considerably the level of the balance of the plans of capital construction, as well as the management of the flows of materials in this sector. All this will make it possible to use more economically the material and technical resources which are being allocated for the purposes of the reproduction of fixed capital.

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## CONSTRUCTION PLANNING AND ECONOMICS

### DEVELOPMENT OF NEW CITIES DESCRIBED

Moscow ZHILISHCHNOYE I KOMMUNAL'NOYE KHOZYAYSTVO in Russian No 12, Dec 82 pp 11-12

[Article by I. M. Smolyar, doctor of architecture, and E. O. Tovmas'yan, architect (Central Scientific Research Institute of Industrial Structures for Urban Development): "A Nation of New Cities"]

[Text] The 60 years which have passed since the founding of the USSR constitute a period of unprecedented economic, social and cultural improvement. Urbanization has been one of its manifestations.

During the period 1926-1982 the nation's urban population increased from 26.3 million to 171.7 million people, and it now accounts for 64 percent of the nation's entire population. New cities have to a significant degree "supported" the process of this growth: They were responsible for an extremely important portion, more than 40 percent, of the total increase in the urban population (145.4 million people).

The number of cities increased from 737 to more than 2,000. More than 1,200 new cities--this is the total for 60 years. It is represented both by small settlements which grew and were transformed into cities, but the main element are the newly constructed cities (around 500 of them), which grew up on empty sites.

This scale of urban development within an unprecedentedly short time is a phenomenon without equal in world experience.

The creation of new cities in the USSR has made it possible:

- to considerably expand the geographic zone for the distribution of productive forces and dispersed settlement;

- to exploit enormous natural economic resources in formerly undeveloped and remote areas;

- to create a more highly developed and even distribution of the nation's network of administrative and cultural centers primarily in former outlying national districts of the tsarist empire, which have now been transformed from backward and oppressed colonies into Union republics with full rights, with a highly developed, multibranch economy and a culture national in form and socialist in essence;

to test on a practical level and extensively adopt new methods of socialist urban development. The new cities, beginning with the first Five-Year Plan, constituted a unique kind of experimental "testing ground" for planning and development.

In the history of Soviet urban development we can identify three generations of new cities: the prewar generation built during the phase when we were accumulating practical experience and conducting diverse theoretical quests during the period of industrialization (Zaporozh'ye, Magnitogorsk, Novokuznetsk, Komsomol'sk-na-Amure), the first postwar generation built during the stage when the national economy was being restored and developed (Angarsk, Bratsk, Vozheskiy, Sumgait, Rustavi); the modern generation built during the stage of expanding scales of construction and achievements in the planning of new cities based on material-technical and scientific progress (Tol'yatti, Brezhnev, until recently known to everyone as Naberezhnyye Chelny, Zelenograd, Navoi, Shevchenko, Sosnovyy Bor, Volgograd, Tobol'sk). Each generation has come closer to being the complete and best execution of that super task for the creation of a new city--to make it an exemplary urban development plan measuring up to advanced theory and practice in planning and development.

During the past decades the network of cities for the nation as a whole has become more evenly distributed. Along with the development of the European part of the nation, we have continued active development of remote areas with unique minerals, raw materials and hydroelectric energy resources. The shifting of industrial centers to the north and east and the continuing buildup of economic strength there is advanced as one of the main tasks for the future as well.

In the Kazakh SSR, for example, almost 80 percent of the network of cities is new. The construction of Shevchenko, a city of oil- and power-industry workers, was begun on Kazakh land, on the Mangyshlak Peninsula of the Caspian Sea, under conditions of great heat, dust storms, absence of fresh water and green crops. New cities have organically expanded Uzbekistan's network of communities. Navoi, a city of chemical-industry workers, was erected in the desert, in the waterless sands of the Karakumy, northeast of Bukhara. In these cities it was necessary to create not simply tolerable, but comfortable, living conditions, in order to attract people to these areas with prospects for the national economy. In Navoi, along with constructing the first groups of apartment buildings, an irrigation system was built and greenery was planted throughout the city blocks. A large nuclear-powered distillation plant was placed into operation in Shevchenko. The city and its "green architecture" received the water. A broad strip along the coast was set aside for public recreation.

The builders of Navoi and Shevchenko were awarded the special international Patrick Abercrombie Prize "for their successful attempt to humanize the traditional city environment under desert conditions." Both the Kazakh Shevchenko and the Uzbek Navoi have now become oblast centers, and their development is continuing.

New cities are growing rapidly in the northern conditions of Tyumen Oblast, personifying the general scope of development in an area in which a huge national economic complex is being created. Among these we could name Surgut as the most brilliant example of comprehensive development of the economy. Oil extraction, an energy industry in the creation, home-building, river, radio, air and automotive transport, lumber and fish industry, and soon gas-refining--these make up the city's economic strength. Surgut is completely developed in the engineering sense: a waterline from artesian wells, a sewage system with purification facilities, electric power from a GRES, heating from rayon boiler rooms. Homes produced by the Surgut combine are in use in other oblast cities.

Nizhnevartovsk, capital of the famous Samotlor, is making an important contribution to the development of the oblast economy and the national economy. The special situation, in which outlays for housing and municipal services were two-three times greater than in the southern part of Western Siberia, brought about an approach to the creation of a general plan for the city based on a centralized system of residential dispersal and made it necessary to strictly mold all the elements in the planning structure and to make efficient use of the buildup area. Specific requirements of the planning structure for the group of cities in the northern part of Tyumen Oblast included increasing construction density, achieving maximum preservation and use of existing green areas, protecting the population against adverse weather during the most difficult time of the year, increasing the calculated norms for cultural and personal service establishments and redistributing the service systems within the boundaries of the residentially developed area.

The new city of Bratsk was created under the severe conditions of Eastern Siberia. On land wrested from the taiga, at that spot where "Ataman Perfil'yev and his comrades set up the Bratskiy watch at Padun on 14 May 1631," the buildings for the world's largest lumbering complex were built. With the start-up in 1967 of the first line of shops the nation received the first products, without which the further development of industry would have been inconceivable. A number of industrial enterprises operate in the city today. They were built according to the latest word in science and technology, and highly skilled specialists work there. It was not by accident that Bratsk became the center of the developing territorial-production complex. The same sort of giant complex is being built with the participation of the CEMA nations 200 kilometers from Bratsk, on the right bank of the Angara, in Ust-Ilimsk. The large construction and production base located in Bratsk is meeting the basic needs of the city's builders.

One might wonder whether it is possible or even necessary in general to build cities in such difficult conditions. It turns out to be both possible and necessary. Economic and social considerations demonstrate the total effectiveness of this plan. The state spends approximately 2,500-3,000 rubles to "settle" one resident in the average new city, but these expenditures justify themselves completely, both socially and economically.

The principles underlying Soviet urban development, which were laid down back during the first five-year plans and developed in subsequent years in scientific

and practical refinements, were affirmed on a practical level during the construction of new cities in Siberia and the Far East, in the Urals and in Central Asia, and in the European part of the nation.

A planned basis makes it possible to forecast in advance the formation and development of the economic (urban development) base and to calculate the size of the population and all the parameters for the social and engineered infrastructure. The most healthy and attractive areas are designated for housing construction; the best linkage is provided between the job site and the residence, as well as among the separate areas of the cities; serious attention is given to the expedient and to the extent possible, evenly dispersed, distribution of cultural, consumer service and educational institutions; great importance is attached to the creation of an attractive artistic-architectural appearance for the entire city, especially the center.

A study of the realization of general plans for new cities, which was performed by the Central Scientific Research Institute of Industrial Structures for Urban Development of the State Committee for Civil Construction and Architecture, which is the head institute dealing with these problems, has shown that new scientific principles for urban development are reflected in urban planning and development practices. The concept of creating in the future group systems of communities, in which the object of the planning and development will be a group of interconnected cities, is becoming more and more prevalent.

When the general plan was put together for Naberezhnyye Chelny, for example, a draft blueprint was worked out for a group system of communities embracing around 12,000 square kilometers and including the cities of Brezhnev, Nizhnekamsk, Mendeleyevsk, Menzelinsk, Zainsk and other communities which have grown up close together along the Kama river.

In accordance with the economic forecast the city of Brezhnev has the highest rates of population growth: from 30,000 in 1971 to 400,000-450,000 by the end of the period covered. This factor as well as the city's central location are important conditions for its development as a multifunctional industrial, scientific and cultural center of a system of communities.

The rapid development of Tol'yatti has resulted from the construction of the Volga Motor Vehicle Plant, the nation's largest. The structural plan was based on the development of a general development scheme for the city. The plan took into account its good economic-geographic location, which makes it possible to coordinate new enterprises with existing ones in Kuybyshev Oblast and adjacent areas, the location of large rail and water communication arteries near the city and the existence of a powerful energy base--the Volzhskaya GES imeni V.I. Lenin.

Sosnovyy Bor near Leningrad came into being as an energy "satellite" based on construction of the Leningrad Atomic Electric Power Plant. It is only slightly more than 10 years old, but it already has several tens of thousands of residents, and its economic base is developing. Sosnovyy Bor is a comfortable city in which

people want to live. Everyone who visits the city admits this. The secret is a simple one: The architectural plan involves organically coordinating the new city with natural conditions. The plan's authors were unquestionably able "to read into" the landscape features of the future layout. This accounts for the outstanding result. The authors of the plan and the builders were awarded the State Prize of the USSR.

The quality and the aesthetic merits of new construction projects are especially important today. The comprehensive approach to housing, cultural and personal service construction is moving to the fore.

The city of Strezhevoy, the support base for the Tomsk oil workers, is a fine example. From the very first the development of Strezhevoy has been carried out strictly according to a comprehensive plan. Cultural and personal service facilities--kindergartens, schools, stores and dining halls--were built in the micro-rayons simultaneously with the construction of residential blocks. The city's housing fund almost doubled during the years of the 10th Five-Year Plan. Each resident receives more personal services, worth an average of 40 rubles per year, than in any other oblast center.

If we take the overall practice of creating new cities as a whole, and not individual outstanding achievements, some of them still do not meet the requirements set for their planning and construction.

...People build cities. They build them so as to live better and more happily on earth. Our nation has everything necessary to achieve this--great expanses, great mineral wealth and inspired enthusiasm on the part of the builders. As much new housing as is required for a city with a population of 500,000 residents is now being built in less than a month.

Leonid Il'ich Brezhnev made the following statement: "The advantages of socialism make it possible to direct the natural process of the growth of cities in such a way that their populations enjoy increasingly healthy and convenient living conditions."

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## AGRICULTURAL CONSTRUCTION

### OREL AREA ILLUSTRATES TRENDS IN RURAL CONSTRUCTION

Moscow EKONOMICHESKAYA GAZETA in Russian No 50, Dec 82 p 17

[Article by M. Mironov, Orlov obkom secretary, under the heading "Construction Effectiveness": "Renewing Orlov Area Villages: Experience in Comprehensive Development of Villages on Farms in Orlov Oblast"]

[Text] For something less than four decades, villages of the Orlov area have been rebuilt in three stages. It is known that the German Fascist occupiers destroyed and burned oblast cities and villages during World War II. We therefore had to put up everything anew right after the invaders were driven out.

Clay was the basic material at that time. Adobe, basket-weave clay, pisé and other structures were built. And people moved out of their dug-outs.

The villages were rebuilt a second time during the 1950's through the 1970's. At that time, the clay buildings were replaced with houses with wooden, brick and cinder-block walls. They were put up primarily using the savings of the populace, without the active participation of construction subdivisions. The houses were better than those previous, but generally lacked municipal services and outside improvements. They, too, quickly became obsolescent for that reason.

And now a third stage is upon us, when we need to rebuild the villages so that they are not inferior to urban housing in terms of space-layout resolution, level of public amenities and comfort, while at the same time taking the specifics of the peasant way of life into account. Not a complex task, at first glance. But practice has shown that an apparently simple solution is a deception, that the problem has been grossly underestimated in a number of instances.

"Skyscraper" or Farmstead?

It was finally determined at the July (1978) CPSU Central Committee Plenum that we need to build farmstead-type houses with farm buildings for keeping livestock and poultry and to meet other needs in rural areas. Practice has shown that multistory villages are not needed, that private subsidiary farming is inconvenient and complicated in them.

Let's examine this using the development of the "Lubyanskiy" sovkhos central farmstead as an example: six two-story multiple-apartment buildings were built

there using a 25th-series design. In terms of space-layout resolutions, the apartments in them are rather good, with every type of municipal services. It is cheaper and faster to build such buildings than farmstead-type ones. Still, they are unsuitable for large-scale rural construction.

The fact is that, as distinct from the city-dweller, the rural laborer does not simply live in his home or apartment, but also runs his private subsidiary plot, whose output must occupy a place of considerable importance in the country's food balance. The development itself must therefore facilitate the production of agricultural output at home, with minimal expenditures of energy and funds. This work, after all, is done on one's time away from one's basic job, with the participation of family members unable to work. But there are no such conveniences in multiple-apartment houses. Therefore, the people living in the village either partly or entirely stopped private subsidiary farming. There was only one cow and 50 suckling pigs on private subsidiary farms on "Lubyanskiy" sovkhoz for the 106 families living in the multiple-apartment houses. This conceals, we think, one of the responses to the current question of the causes of the drop in the number of head of livestock on village private subsidiary farms.

The leaders of Dmitrovskiy Rayon must be given credit for noticing this negative phenomenon and taking steps such as shifting to large-scale rural development in the form of single- and two-apartment farmsteads with full sets of farm buildings using new plans developed by the "Orelgiprogorssel'stroy" institute. Many oblast villages are now being developed using them, but they were used first in Dmitrovskiy Rayon. Much experience in installing and operating them has already been accumulated here.

An oblast seminar devoted to the comprehensive development of villages was therefore held recently with Dmitrovskiy Rayon as its base. Its participants exhibited great interest in evaluations of the new plans by the new residents themselves. The responses were most complimentary. They were pleased not only by the space-layout resolutions and comfort the equal of urban housing, but also by the well thought-out resolution of the whole village farmstead.

This convinced us once again of the value of the large-scale, successful search made by our engineers and architects. They had to do this because the existing standard plans for farmstead-type buildings turned out to be unsuitable. They generally contained blueprints for the house only, whereas to the village resident, the farmstead as a whole is important: farm and other buildings, together with the housing, comprise a unified whole, the farm buildings being like an extension of the house and functionally linked to it.

These requirements were made the basis for developing rural farmstead plans by our planners. Also taken into consideration were such questions as standardization, industrialization and others which enable us to build housing on a modern technical basis and to achieve with a limited set of plans a situation in which village houses are not like one another, in which the build-up is not monotonous, boring and featureless.

#### Using the New Plans

Now we can say the task has been resolved. We have succeeded in developing plans and building up rural farmsteads using housing and farm building units



which include one- or two-apartment farmstead houses with two, three and four rooms, a kitchen-dining room and farm buildings. For convenience and to lower expenditures, the house is a unit with the building housing the livestock and poultry as defined in the kolkhoz charter, as well as with the garage and cellar.

The plans for such farmsteads were worked out for the contractor and direct-labor methods of construction, with brick walls and prefabricated keramzit-concrete panels of the 25th rural series and the 111-121 urban series. Moreover, for the first time in this country, we developed a plan for and built up a farmstead using monolithic keramzit-concrete housing and farm-building units. The walls of such houses are poured in an adjustable metal form to their full height in 4-5 hours and the whole construction cycle lasts 3-4 shifts.

The annual economic impact of using monolithic keramzit-concrete in one single-apartment housing and farm-building unit is 1,000 rubles as compared with brick buildings and 3,000 rubles as compared with large-panel buildings. If consideration is given to the fact that we need to build 3,000 to 3,500 houses a year in our oblast, the impact is significant. These houses require no large-panel house-building plants or special transport, and they are warmer than large-panel houses. We have decided to begin the large-scale construction of such houses in rural areas.

All the housing and farm-building unit plans are standardized and three roof and facade finish variants each, which enables us to obtain 12 different silhouettes with different combinations of module arrangement and brickwork. And the use of architectural details with elements of folk architecture and color combinations eliminates entirely uniformity in space-layout resolutions in the countryside.

The area of the farm plot adjacent to the house has been set at 12-15 hundredths of a hectare, and the remaining allotment of land provided under the kolkhoz charter is available as a common garden. Using different farmstead arrangements, we obtain village streets and with them, well laid-out, modern villages with the whole complex of cultural and personal-services facilities.

#### Who Builds Rural Houses?

In connection with the sharply growing amount of work, all rural contractor construction and road-building organizations are now engaged in rebuilding villages. Moreover, subdivisions of the Orlov Construction Administration of the USSR Ministry of Industrial Construction have also been involved, the Nonchernozem Zone projects program having been increased from six percent of the total in 1975 to 33 percent in 1982.

Even under these conditions, only 73 percent of the total amount of rural construction-installation work is being done by the contractor method. The remainder must be done by the direct-labor method.

Our oblast has 403 kolkhozes and sovkhoses and 58 contractor construction-installation subdivisions (construction-installation administrations, mobile mechanized columns, MPMK [not further identified]), many of which are small, with annual work programs of under 1.5 million rubles.



Dmitrovskiy Rayon has no advantages whatsoever over others. But it has used the available opportunities skillfully and effectively. Each contractor organization or sector builds its "own" village.

A construction sector of the Orlov Repair-Construction Trust is operating in the central farmstead of "Dmitrovskiy" sovkhoz. This year, it has released 10 farmsteads with brick houses and farm buildings. And this sector was not planned for work in rural areas. But communists and leaders in the sector decided not to remain on the sidelines, but to take a very active part in implementing the resolutions of the May (1982) CPSU Central Committee Plenum and requested party organs to grant them an opportunity to build two villages. The result was new houses and new settlers in the sovkhoz.

The villages are being rebuilt on the basis of kolkhoz, sovkhoz and rayon socioeconomic development plans. It is being run directly by the party raykom and rayispolkom, with the active participation of the primary party organizations, people's deputies and economists. Capital construction questions are systematically discussed at party raykom plenums and bureau meetings, in sessions and ispolkom meetings of the rayon and village soviets. The party raykom has created a party leadership headquarters for housing and sociocultural construction.

Particular attention is being paid to training and educating cadres and to the placement of communists. Either party groups have been created or party organizers have been designated in the construction brigades. The kolkhoz and sovkhoz primary party organizations have begun paying more attention to questions of capital construction and village rebuilding, to helping overcome the difficulties, of which there are still quite a few in this large, complex task.

#### In Consideration of Changes

We should first of all note the shortage of many types of materials, as well as sanitary-engineering and electrical equipment. This occurs due to two reasons. First, in planning, consideration is still not always given to change in the structure of construction in rural areas, where the levels of production construction are lower and the amounts of nonproduction construction are sharply higher, where, instead of multistory buildings, we are building farmstead homes which require higher material expenditures. Second, enterprises of the USSR Ministry of Ferrous Metallurgy, USSR Ministry of Construction Materials Industry and USSR Ministry of Timber, Pulp and Paper, and Wood Processing Industry generally pledge partially and unevenly what are in any case modest stocks. The USSR Gosplan and RSFSR Gosplan, jointly with the ministries and departments, need to re-examine the existing normatives setting resources for rural construction.

Moreover, there are quite a few miscalculations by party, soviet and economic construction leaders here. We have not yet been able to overcome in all cases the psychological barrier of directing the attention of the leaders of individual construction subdivisions, kolkhozes and sovkhozes, as well as the deputies of the rayon and village soviets, to this most important problem. Unfortunately, there are also farms which have not seriously begun rebuilding their villages. But there are fewer with each passing year, and the day is not far off when there will be none at all.

The nearer the remarkable celebration of the 60th anniversary of the formation of the USSR, the greater the fervor or the socialist competition among builders. For the oblast as a whole, the housing starts plan is being overfulfilled. Construction is proceeding smoothly.

During the first nine months of the year, contractor organizations carried out 81 percent of their 1981 work program for housing construction, releasing for operation 72 percent of the total space planned for start-up this year. And the Orlov "continuous [construction planning]" system, which has proven its viability, is being widely used at construction sites in the Nonchernozem Zone.

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CSO: 1821/33

## BUILDING MATERIALS

### GOSPLAN EXPERT OUTLINES TARGETS FOR BUILDING MATERIALS

Moscow AGITATOR in Russian No 14, Jul 82 pp 36-38

[Article by R. Kotlova, senior expert, USSR Gosplan Department of Consolidated Five-Year and Annual Planning: "Construction Materials" Passages in boldface enclosed in slantlines]

[Text] The construction materials industry, together with the metallurgical chemical, the forestry products complex, and the machinery building industries, is, figuratively speaking, the rear area of our huge construction front, a rear area upon which the front's success to a considerable degree depends. The Soviet state allocates large capital investments to the development of the construction materials industry. In the 8th Five-Year Plan they amounted to 6.3 billion rubles, in the 9th, about 8.5 billion, and in the 10th Five-Year plan they exceeded more than 9.2 billion rubles.

Thanks to the construction of a number of modern new enterprises, and the expansion, reconstruction, and technical modernization of many existing enterprises the sector's capital-labor ratio, calculated per worker, has more than doubled since 1970. Labor productivity increased by a factor of 1.4 and output increased 1.6 fold. /Our nation is now first place in the world with regard to the production of cement, precast ferroconcrete structures and parts, plate glass, asbestos cement, and many other items./

The attained level of production meets most of the nation's current needs. Most, but still not all, there are still breakdowns in the supply support of projects and in the sales of building materials to the public.

/The 11th Five-Year Plan calls for a 17 percent increase in the sector's output./ Ninety percent of the increase in output will be obtained through increases in labor productivity. In accordance with the directives of the 26th CPSU Congress it is intended to place preference upon the production of items which reduce the metal intensity, cost, and labor intensity of construction, and increase its thermal insulation qualities. The proportion of items with the State Mark of Quality in the total production volume of the USSR Ministry of the Construction Materials Industry (the main supplier of the sector's output) should increase from 14 percent to 22 percent during the five-year plan.

Let us examine in more detail the situation in some of the main subsectors. We will begin with /cement/, properly called the bread of construction. The increase in its production in the USSR, compared to other nations in the world, can be seen from the table (millions of tons).

[Table 1. Cement Production]

	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1980</u>
USSR	10	46	95	125
European Socialist Nations	9	25	47	75
Other Socialist Nations	2	18	19	102
United States	39	56	67	77
Great Britain, FRG, and France, total	34	69	118	124
Japan	4	22	57	88
Rest of the World	36	81	171	297
<hr/> World total	<hr/> 134	<hr/> 317	<hr/> 574	<hr/> 888

Back in the first half of the 1960's our nation passed the United States in cement production, and now it has passed the four most developed nations in Western Europe taken together. We now produce almost as much cement as the entire world did in 1950. However, with respect to production per capita we lag behind a number of socialist nations, Italy, FRG, France, and Japan.

In view of the requirements for cement, during this five-year plan it is intended to increase its production by 10 percent. It is also planned to put 12 new production lines into operation, modernize existing ones, and improve their utilization. So far, the full utilization of the most productive 185 meter long kiln has been attained at the Sebyakov, Amvrosiyev, and Akmyansk enterprises, , and in general the capacity of these assemblies is only 85 percent utilized. In 1981 there were more than 145,000 machine hours of idle time at all revolving kilns due to emergencies caused by the violation of technological procedures, and cut-offs in gas deliveries. This alone caused shortages of more than 4 million tons of cement.

Cement quality continues to improve. Its average grade, determined by the ultimate strength during compression, in kilograms per square centimeter, reached 410, compared to 407 in 1980 and 383 in 1970. The proportion of cement in grade 500 and above increased to 22 percent. According to guideline studies, improvements in assortment will reduce cement consumption by 1 million tons by the end of the five-year plan.

The 26th CPSU Congress has obligated us to accelerate the development and introduction of energy saving technology in the production of cement, glass, and lime, economic methods for heat treating ferroconcrete items, and for firing ceramic items. This is an especially pressing problem for cement plants. After all, they consume more than 22 million tons of fuel annually, and their expenditures for fuel and energy account for one-third of all production outlays, while for the construction materials industry as a whole this figure is only 11 percent, and for all industry together it is 6 percent.

One of the ways of saving fuel is through the complete utilization of the capacity of large units and through this take out of operation the obsolete equipment, which requires 1.5 fold more fuel consumption per ton of cement production than the modern kilns do.

Another way is to replace the presently predominant traditional wet method of cement production with the dry method. This would reduce fuel consumption by 30-40 percent. We lag behind other nations in the introduction of this method. It accounts for less than 15 percent of our output. In 1982 a large unit capacity production line using the dry method will be put into operation at the Krivoy Rog Plant. It is intended here to further develop this equipment for mass introduction at cement plants in the future.

About one-third of the cement produced in the nation goes to the fabrication of /precast ferroconcrete structures and items./ During the past two five-year plans their production has increased from 85 million cubic meters to more than 122 million. In the current five-year plan it will increase by 10 percent, of which prestressed structure production will increase 11 percent, and items using light aggregates will increase by 24 percent.

In accordance with the directives of the 26th Party Congress it is necessary to modernize /brick/ production, based upon the newest technology, equip many plants with fundamentally new equipment, and sharply increase labor productivity and improve its conditions.

There will be an increase in the production of / soft roofing materials and asbestos cement sheets/ slate).

Asbestos cement sheets and pipes, manufactured from chrysolite-asbestos and cement are economical and high strength. We are considerably ahead of the most advanced capitalist nations with respect to their per capita production. About one-half of all roofs and protective structures are now made from slate. Asbestos cement pipe can effectively replace metal pipe in land reclamation projects.

Asbestos cement industry enterprises must improve existing capacity utilization increase the production of large dimension fiber and flat sheets, and master the large scale production of sheets by the extrusion method (squeezing a mixture out through an extrusion die of the appropriate shape). This will permit the use of lower grade asbestos and will result in products which can successfully replace concrete slabs.

It is planned to increase the production of asbestos cement pipes by 19 percent, this includes a 26 percent increase in the production of 5-6 meter pipe. Such pipe, which compared to four meter long pipe, reduces the number of joint connections during pipelaying. It requires 20 percent fewer sleeve joints and reduces the labor required for installation work by almost the same amount.

The production of /construction ceramics/, based on the introduction of high speed manufacturing conditions will receive further development. There will be an especially rapid increase in the production of glazed ceramic tiles for interior walls. By the end of the five-year plan their production will reach 43 million square meters compared to 32.6 million in 1980 and 17.2 million in 1970.

The production of /building glass/ must be increased to almost 300 million square meters, including 269 million of window glass. Quality will be improved, and there will be increases in the proportion of art glass, safety glass, vitrified glass, and especially important, of the so-called uniform (mernyy) glass. Its share in total window glass production will reach 58 percent, compared to 54 percent in 1980 and 36 percent in 1970. The delivery of pre-cut glass to builders reduces the labor required at construction sites. In addition, the cutting wastes at the glass plant are returned to the furnace.

Glass industry workers must intensify a number of manufacturing processes, improve the utilization of productive capacity, and increase annual output, which at a number of plants is still below the norms. If the coefficient of utilization of the glass mass is increased by one percent, then, using the same amount of raw materials, one can increase the production of window glass by more than two million square meters.

The five-year plan calls for a significant increase in the supply of cement glass, slate and other construction materials to be sold to the public, however, their basic consumers remain, naturally, construction projects. Here, / it is necessary to sharply reduce losses, and have a genuinely thrifty attitude towards material values/. For example, it is planned to save 5-7 percent of the cement. This is about five million tons, or the annual production of three large plants.

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## BUILDING MATERIALS

### INCREASED PRODUCTION, USE OF 'ARBOLIT' PLANNED

#### Manufacturing, Introduction Experience

Moscow NA STOYKAKH ROSSII in Russian No 9, Sep 82 pp 2-8

[Editorial introduction to three related articles on "arbolit" under the general heading: "Developing the Production and Use of Effective 'Arbolit' Components and Items"]

[Text] The "Basic Directions of USSR Economic and Social Development in 1981-1985 and Up To 1990" anticipate the preferential development of items whose production is less metals-intensive, with lower cost and labor expenditures, which ensure a reduction in the materials-intensiveness and weight of buildings and structures and improvement in their insulation. In this regard, it stresses the necessity of widely involving recycled material and fuel-energy resources, wastes and by-products in economic circulation, which will, in addition to everything else, facilitate revivifying the environment. As domestic and foreign experience shows, one effective way of resolving this task is to use "arbolit," a light concrete using organic aggregates and permitting utilization of production waste from lumbering, milling, wood processing and wood-chemical production and agricultural crops (hemp and flax scutch, cotton stubble and rice straw). It is estimated that use of one percent of these wastes will enable us to obtain more than a million cubic meters of arbolit and to save more than a million cubic meters of scarce porous aggregates, 100,000 tons of conventional fuel and 1.5 million cubic meters of commercial wood each year. Arbolit components are distinguished by low density, good heat and sound insulating properties, biostability, relative inflammability, ease of finishing, sawing and nailing. The net cost of arbolit items is 25-30 percent lower than cellular and porous-aggregate concretes. Expenditures per square meter of wall are 6.5 rubles lower and installation labor-intensiveness is four-fold lower than for brick. In view of these merits, arbolit construction has found broad application, especially in village and forest settlements. It is successfully replacing traditional construction materials such as brick, wood and concrete in low housing, cultural and personal-services facilities and agricultural production buildings. Support wall units and panels, roof and span slabs are manufactured from arbolit. The past decade was a period of the practical establishment

of production of this effective material. Scientific research, planning and production organizations did the basic work on selecting the composition of the mixture and various equipment and technological production schemes were worked out. Builders became accustomed to erecting buildings out of arbolit. The basic normative-technical documentation was worked out and approved. Currently, 13 arbolit components shops with a total capacity of upwards of 100,000 m<sup>3</sup> per year are operating in the Roskolkhozstroyob'yedineniye system, 12 with a total capacity of about 200,000 m<sup>3</sup> per year are operating in the USSR Minlesbumprom [Ministry of Timber, Pulp and Paper, and Wood Processing Industry] system, and the largest, most modern plant, the Dmitrovskiy, with a capacity of 50,000 m<sup>3</sup> per year, is being built in Moscow Oblast. Other departments are also beginning to release arbolit. Construction with arbolit will grow due to the installation of new plants with modern, progressive equipment and technology, by improving the quality of the material and by effective building planning resolutions. Below, we are publishing articles devoted to experience in manufacturing and using arbolit components, to scientific research in this field and to improving the effectiveness and quality of the material.

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Manufacture, Use: 'Lenles' Official

Moscow NA STROYKAKH ROSSII in Russian No 9, Sep 82 pp 2-8

[Article by "Lenles" Association Deputy General Director A. Kozlov (USSR Minlesbumprom): "Arbolit: Manufacturing and Introduction Experience"]

[Text] "Arbolit" -- in literal translation from the Greek, it means wood-rock. It is an effective, light concrete consisting of a mineral binder (cement, gypsum) and organic aggregates (lumbering, milling and wood processing wastes, tan wastes, cotton and rice straw stubble fragments, flax and hemp scutch), chemical additives and water. It is biostable and burns with difficulty, has good heat and sound insulation properties, and is easily finished with cement, lime and plaster of Paris solutions, sawed and nailed. Its density is 400-800 kg/m<sup>3</sup>. One cubic meter of arbolit saves 1.5 m<sup>3</sup> of commercial wood.

According to USSR Gosstroy NIIES [Scientific Research Institute of Construction Economics] and Minlesbumprom TsNIIME (Central Scientific Research Institute of Mechanization and Power Engineering) data, the technical-economic indicators per square meter of dead wall made of various materials are as follows (see table, following page).

Naturally, it is most expedient to organize arbolit production near sources of raw material, lumbering and wood processing enterprises, which often do not know what to do with their wood scraps.

Currently, one of the leading shops is the arbolit shop in the Oyatskiy Rafting Office of the "Lenles" production association (Lodeynopol'skiy Rayon, Leningrad Oblast), which was used as the base for a 1981 All-Union Scientific-Technical Conference on Further Developing the Production and Use of Effective Arbolit



	(1)	(2)	(3)	(4)	(5)
density, kg/m <sup>3</sup>	700	900	700	1,800	800
thickness, cm	25	26	25	66	18
component weight, kg	175	270	175	1,200	135
calculated "actual" net cost, rubles	7.4	10.7	9.9	16.8	15.3
specific capital investment, rubles	9.5	28	25.1	36.3	18.2
labor intensiveness in manufacture and installation, man-hours	2.7	4.0	3.6	8.6	--

Key:

1. Arbolit
2. Claydite-concrete
3. Cellular concrete
4. Ordinary brick
5. Beam

Components and Items in Construction, which was organized by the USSR Gosstroy, jointly with the "Lenles" association.

Conference participants gave high evaluations to operation of the shop and the quality of its output and the projects erected -- farmstead-type housing made of arbolit in the lumberworker settlement of Moshkino (Domozhirovo), Oyatskiy office. It was recommended that this settlement subsequently be converted into an experimental-demonstration settlement.

This success was a result of many years of planned efforts. In 1968, the association's seven-year program of socioeconomic development was drawn up in anticipation that all the wood procured would be used, the wood scrap being used to create a new building material to meet the association's own construction needs. The traditional method of construction, in which logs were the main material and the hand saw and ax the basic tools, was to have given way to industrial methods.

Today, now that all the measures in this program have long been introduced, it may seem strange that lumbering would not involve the use of all the wood cut. But in the 1960's, thousands of cubic meters of sawn and cut aspen and small, trimmed conifer logs remained in felling areas in even well-developed oblasts such as Leningrad due to the limited use (marketing) of commercial broadleaf wood, and especially firewood (as the city changed over to gas as its fuel).

The "Lenles" includes one floating and 13 fixed lumbering enterprises (timber industry enterprise), a lumber packaging combine and a tractor repair plant. The association has 40 settlements in which about 30,000 people live. The usable housing area totals about 400,000 m<sup>2</sup>. We are building all facilities using only the direct labor method and only those materials we can acquire [ourselves]. Funds are needed to acquire reinforced and ordinary concrete. We did not have them, and even so, it was sometimes impossible to bring in those components and materials or, if we did, we couldn't unload them due to a lack of equipment, not to mention building them ourselves.

And so there appeared wooden settlements, production buildings and (log) roads. Annual wood expenditures to maintain settlement facilities and lumbering capacities increased incredibly quickly. By 1968, they had reached several tens of thousands of cubic meters and were continuing to grow.

Settlement maintenance and major repair expenditures also grew astronomically fast. They reached 3,340,000 rubles in 1980, at a time when 900,000 to 1.2 million rubles were being spent annually on new construction and approximately 10,000 m<sup>2</sup> of space was being erected. And even that was not enough, as we now require more substantial housing with more conveniences. That is why we so persistently sought out a new building material.

In the first stage, we organized the construction of housing, store and warehouse buildings made of sawdust-concrete, which was a step forward, but an inadequate one, as this is a seasonal and labor-intensive material. Familiarization with the first arbolit plants at Lyuberetskiy (Moscow Oblast) and Vasil'yevskiy (Tatar ASSR) gave us confidence that its production and use in housing, cultural and personal-services construction is effective.

We chose the Oyatskiy Rafting Office in Domozhirovo settlement, Lodeynopol'skiy Rayon, as the site for the shop. This choice was substantiated both by its geographic location relative to the timber management enterprises (central to them) and by the fact that a gradual cessation of rafting logs on the Oyat' was anticipated, so the workers thus freed could be transferred to the wood processing and arbolit shops. A site was set aside on Yarovski island near an existing packaging shop.

How would the shop be built, using what plan? The technology in the first arbolit plants was primitive and the quality of their output poor. What is more, they used only conifer chips.

Inasmuch as arbolit has a macroporous structure with open intergrain space, in order to produce good-quality items we needed a technology which met three conditions: optimum mixture composition, minimal changes in prescribed item dimensions after molding, and optimum finished product structure.

In this regard, consideration should be given to the fact that the strength of arbolit is directly proportional to the activity of the cement and its expenditure per cubic meter of material, to the shrinkage, strength and adhesion coefficient of the wood aggregate relative to the cement binder, and is inversely proportional to the water-soluble wood substances content, to the wood's shrinkage and swelling. Cement expenditure must be effective, naturally, or else the weight of the item increases, its thermal properties worsen and the net cost of the output increases.

At that time, there were no suitable plans. In 1969, our small design bureau adapted a plan for a two-span 2 x 12 x 72 meter reinforced-concrete plant building 9.6 meters high for a 10,000 m<sup>3</sup> arbolit shop. The shop was built by the direct labor method, using the manpower and funds of the Oyatskiy office (its production development fund). The building proper was built in a year. We then erected an elevated water tank with pipes and collectors, a household-services building and laboratory, a pump station and silo towers for the cement.

In the building, we put shelving under the concrete-mixing equipment, thus saving what would have been spent on a separate concrete-mixing shop and making it easier for the operator to run the mixing and pouring into molds. Also installed were a flow line to obtain aggregate in the required chip size, a DEU-2

hopper, a DM-2 hammer mill, and installations for wetting the chips and feeding them, water and cement mechanically into the mixer and yielding an arbolit mix of optimum composition.

The method of shaping the mixture was developed by the TsNIIME using an LV-24 hydraulic press and metal forms with fixed lids. This method was called "vibro-pressing" and the installation itself a "vibropresser." The TsNIIME also manufactured the equipment and helped install it. It was put in span No 1. This molding flow line provided the necessary degree of arbolit mixture compaction and, in so doing, provided the required strength and other indicators.

Difficulties were encountered, however, in speeding up the cement hardening, which was associated with the soluble sugars content of the deciduous wood. They retarded hardening, which had a negative effect on retaining the prescribed dimensions of the items after being broken out of the molds.

We initially used conifer wood chips, inasmuch as they had nearly no water-soluble sugar. Beginning in mid-1974, we began producing arbolit house building units in the following dimensions in span No 1:  $2.3 \times 1/25 \times 0.25$  (wall),  $0.8 \times 1/2 \times 0.25$  (window-sill),  $2.3 \times 0.6 \times 0.25$  (lintel) and several other type-sizes.

Using Volkhovskiy plant cement with chemical additives such as calcium chloride and subsequently aluminum sulfate significantly improved the strength of the cement blocks which hardened in a medium of well-soaked organic aggregate. Since 1975, based on research done jointly by our ministry and the Soyuznauchplitprom [not further identified], we have been using deciduous chips in every ratio.

The introduction of forms with fixed lids permitted eliminating elastic deformation of the mixture. Items remained in the molds with the fixed lids for 24 hours and were then kept in the shop for 5-6 days after being broken out, in span No 2. A good arbolit, brand "25-35" was obtained, but at what cost? It was too wasteful to use a 12 x 72 meter shop span for seven days just to mature items. And in the winter, the holding time increased to 10-15 days. We had to increase the cement expenditure, since the delay in hardening worsened the strength of the material.

What was the solution? Items like concrete cannot be steam-cured at  $+90^{\circ}\text{C}$  and 100-percent humidity, since the wood once again releases soluble sugar and retards the hardening of the concrete.

We were not able to avail ourselves of outside experience. All the other plants were producing three-layer items with upper and lower layers of heavy concrete and an inner layer of arbolit. The operating qualities were somewhat poorer and the cement expenditure higher, but the items could be heat-treated, thus accelerating hardening.

We took another path and built a warm 50 x 12 meter warehouse to hold the arbolit for five days after the forms were removed. Recent research and experience have shown that the optimum temperature for hardening arbolit is  $+40^{\circ}\text{C}$  and optimum humidity is 50-60 percent. Our experience confirmed that, under these conditions, the items met the requirements of GOST [All-Union State Standard] 19222-73, "Arbolit and Items Made From It."

The warm warehouse enabled us to free the shop span previously used to heat products, creating an opportunity to increase the release and broaden the products list of the output, to use available production premises more efficiently.

Back in 1975-1979, due to its interest in having an experimental base, the Soyuznauchplitprom manufactured one and used it to install and master a VL-125 vibro-pressing installation in a small part of span No 2 to produce 6 x 1.2 x 0.2 meter reinforced wall panels for industrial buildings and nonreinforced panels for housing. It has a number of advantages over the LV-24 line, as its productivity is 15 percent higher and the quality and strength of its output are better.

In 1980, the NIIZhB [Scientific Research Institute of Concrete and Reinforced Concrete], at our request, manufactured a machine tool for cutting arbolit items which was installed in a special 30 x 12 meter building. After drying and holding, six-meter panels are cut into appropriate-sized blocks following charts for providing future projects with complete sets of items. This technology not only increases production, but also reduces the number of metal form type-sizes to 1-3, instead of 15-20, as well as reduces finished-output remnants.

Since August 1981, when the warm warehouse for holding items was put into operation, arbolit blocks for house building have been produced only in the second span, on the VL-125 line. The results confirm preliminary calculations: 12,000 cubic meters of output is being manufactured, instead of the 10,000 m<sup>3</sup> previously. This increment provides an opportunity to go back to manufacturing six-meter industrial building panels in this span without reducing the production of parts for housing. The LV-24 line is being modernized and will be capable of compression-molding items up to four meters long, which will provide an opportunity to produce 3.6 x 1.2 x 0.18 meter between-floor slabs, 4,000 m<sup>3</sup> worth, in the first span area thus freed. This will increase the degree of house prefabrication and save more than 4,000 m<sup>3</sup> of high-quality conifer lumber currently being used in interfloor overlaps.

Increasing arbolit production naturally also requires an increase in the amount of raw material. Our current technology for preparing aggregate is imperfect, since we are forced to collect scraps in the packaging shop, load them onto motor transport and load them by hand onto the conveyor feeding raw material to the chopping department, at a time when chips are being transported considerably better.

We have now developed a more convenient technology for obtaining aggregate. When they leave the packaging shop, scraps (side pieces and edging) will be chopped into chips and pneumatically taken to a 6,000 m<sup>3</sup> open storage yard and then carried by conveyor to a collector hopper, then the hammer mill, and on to the manufacturing flow.

Neighboring timber management enterprises (Pashskiy and Lodeynopol'ekiy) will not provide sufficient chips. Incidentally, storing the chips in an open yard will facilitate aggregate desaccharification.

A small investment in arbolit production renovation will enable us to increase production two-fold and manufacture a full products list of items for civil and industrial construction. Over the next two or three years, we intend to set up

the release of a variety of effective items from brick to room- and even apartment-sized panels. The brick could be used to put up homestead- and orchard-type homes where cranes cannot be used, the blocks -- for facilities in difficult-access terrain, and the panels -- under industrial construction conditions.

The output of the Oyatskiy Rafting Office arbolit shop is popular. The first two-story, two-apartment house was built with arbolit in 1974 in Vasnova Kara microrayon, Moshkino settlement, using a series 141-115 Giprolesprom plan.

A seminar was held with timber management enterprise leaders to popularize what was at that time the "new" product. There was no need for special urging, as the material and the project spoke for themselves. Beginning in 1975, all timber management enterprises stopped building housing with wood, replacing it entirely with arbolit.

In spite of the meager number of standard plans (2-3 types), preference was given to houses made of arbolit in lumberer settlements. The years passed, and new plans appeared, as did solitary, interspersed buildings, then streets of buildings, then microrayons and even settlements made of arbolit. The advantages provided by arbolit were architectural expressiveness, industrialness, well-provided with amenities, substantialness and durability.

We have now developed plans for a number of settlements made with arbolit: Sarka, Tikhvinskiy TME [timber management enterprise] (developed by the Giprolestrans); Moshkino, of the Oyatskiy Rafting Office; Zabor'ye, Podborovskiy TME, and Andronovskiy microrayon in Lodeynoye Polye (Lengrazhdanproyekt). Their implementation will enable the association to successfully resolve important socioeconomic tasks.

Public buildings as well have been built with arbolit: a kindergarten and club (Koli settlement, Yefimovskiy TME), stores and boiler rooms (Domozhirovo settlement, Oyatskiy office and Lesozavod, Pashskiy TEM), a woodworking shop (Kurbe settlement, Vinnitskiy TME), warehouses for workers supply departments, and a number of other facilities.

Oblast sovkhoses are building pigpens and cow barns using arbolit. Due to its macroporous structure and hygroscopic aggregate (chips), arbolit does not sweat and creates a good air exchange and microclimate. All this helps improve livestock maintenance.

The Lengrazhdanproyekt Institute is currently working on plans for building up a number of arbolit villages in the oblast's Lodeynopol'skiy and Podporozhskiy rayons. Horticulturists and car-lovers are requesting arbolit. It has no equals as a material for these purposes, which is why oblast sovkhoses are increasing their requests for arbolit deliveries year after year, and we are meeting those orders.

And we have also encountered difficulties. Thus, we have not yet solved the problem of foundation design. Traditional materials are too heavy and expensive for arbolit houses. Footings and foundations are significantly heavier than walls and copes. An SF-4 foundation block is 40 cm or more thick, but for arbolit we need blocks 10-15 cm thick; only in the base do we need blocks 60-80

centimeters thick. In this connection, we are faced with beginning to produce special foundation blocks for arbolit house-building.

We are building and overhauling millions of rubles worth of facilities each year, all by the direct-labor method, and are maintaining repair-construction sectors in the timber-management enterprises, which diverts considerable basic timber-procurement worker forces.

The timber-management enterprise leadership is especially troubled by the lack of complete sets of materials, including wooden ones. Whereas a four-apartment, two-story arbolit house can be put up in two weeks, it takes 10 months to put it into operation, since the wooden parts are made locally, with blade and axe, cabinetry is sought in all city and oblast wood processing enterprises, and sanitary-engineering items are also manufactured by the people themselves, locally. This leads to unjustified overexpenditures of materials and live labor, poorer quality work, and disruptions in timber procurement smoothness and plan fulfillment.

In this connection, we began developing our own assembly-component production base (PKB) in 1978. We directed 10 percent of our deductions from funds for housing major overhaul, 133,000 rubles, into this. Using them, we built a shop for holding and cutting arbolit and cabinetry in four years; its capacity is 8,000 m<sup>3</sup> of raw material. This year, we will put into operation a wooden house parts shop city a capacity of 20,000 m<sup>3</sup> of raw material, set make-up and finishing of arbolit items.

We have begun building a 60 x 18 meter metal-products shop with a capacity of one million rubles of output and a 72 x 18 meter set make-up warehouse, which will begin operating in 1983. We are readying the estimate-planning documentation for a 50,000-m<sup>3</sup> capacity double-frame sawmill to be built in 1985-1986.

We would very much like to speed up the installation of assembly-component production base facilities, but not much can be built on 133,000 rubles per year. The PKB complex will enable us not only to increase arbolit production and use 1.8- to two-fold, but also to concentrate the entire volume of wood being used both for new construction and for overhauling and maintaining our facilities. All pieces of scrap are going into arbolit production.

Production of the currently scarcest log panels for timber-hauling roads will be organized in the wooden parts shop so all the association's timber-management enterprises can be provided with them.

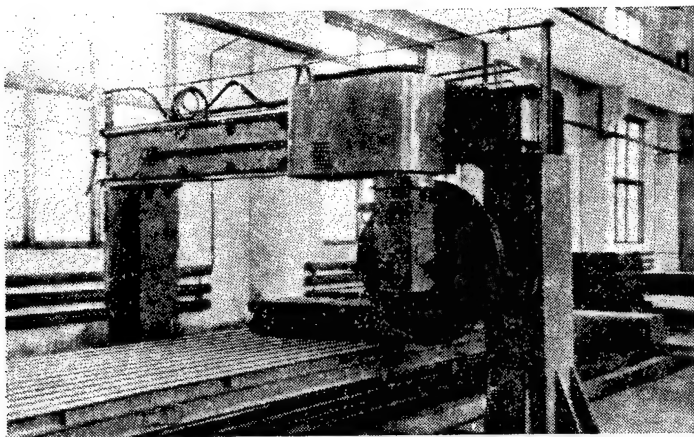
Construction of the set make-up warehouse and metal products shop will enable us to provide projects with glass (to size), paints (in small packets and appropriate colors), wallpaper, linoleum, shingles, roofing felt, and so forth. Manufacturing reinforcing rod for arbolit items, pipe (sanitary-engineering) products, batching parts and nonstandard equipment will not only put the expenditure of these materials into proper order and improve their storage and recording, but, more importantly, accelerate the installation of facilities.

Organizing the transport base and obtaining vans with saddle-type couplings will enable us to deliver all complete-assembly parts promptly and directly to the

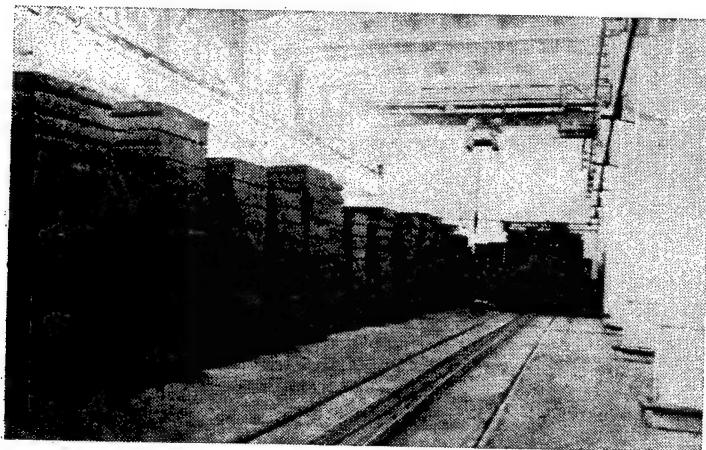


project or floor. The construction site will be clean and the standards high. This will be facilitated as well by the creation in the arbolit shop of a project installation and finishing-work brigade.

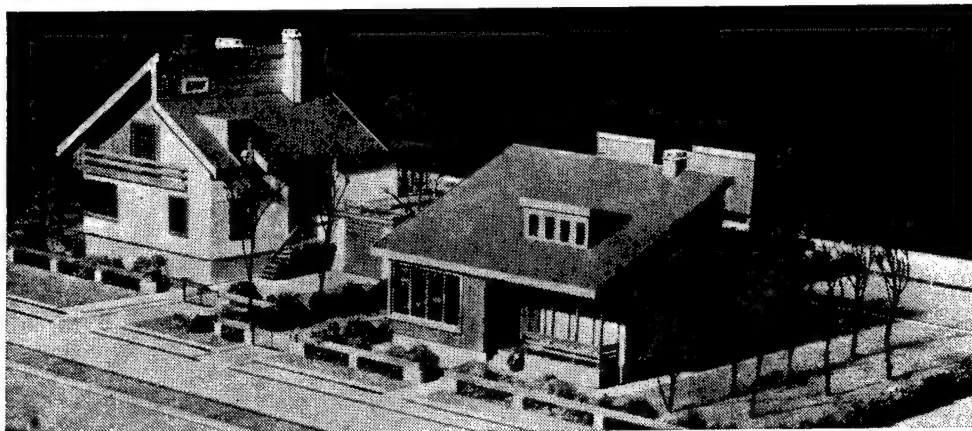
The allocation of some state capital investments would accelerate the creation of the PKB and free the timber-management enterprises from doing housing construction and major overhaul work not their own. The volume of own housing construction would increase to 15,000 - 20,000 m<sup>2</sup>, which would help eliminate the manpower shortage and, in so doing supply Leningrad economic region better and more steadily with timber products.



Arbolit Cutting Shop. Foreground -- Cutting Machine



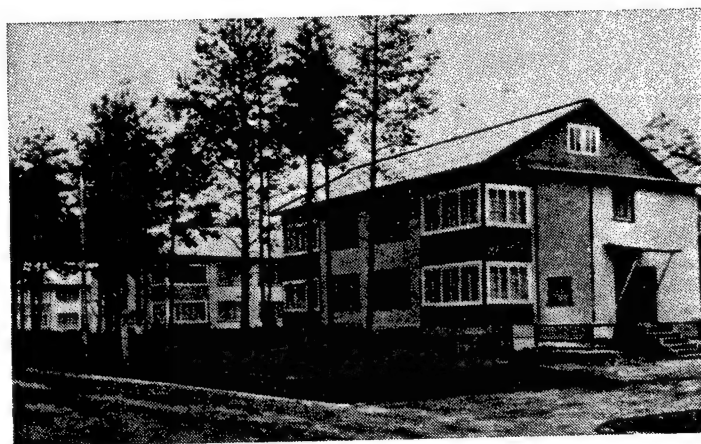
Arbolit Holding Warehouse at the Oyatskiy Rafting Office



Series 115 Arbolit House in Domozhirovo Settlement (Giprolesprom design)



Single-Apartment, Five-Room Farmstead-Type Arbolit House (Lengrazhdanproyekt)



Models of Five- and Three-Room Arbolit Houses (Lengrazhdanproyekt design)

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## Recent Arbolit Research Detailed

Moscow NA STROYKAKH ROSSII in Russian No 9, Sep 82 pp 8-11

[Article by Professor and Doctor of Technical Sciences K. Mikhaylov, director of the USSR Gosstroy's NIIZhB (Scientific Research Institute of Concrete and Reinforced Concrete): "Scientific Base of Arbolit Production Development"]

[Text] The USSR Gosstroy, USSR Gosplan and USSR State Committee for Science and Technology have included in the target comprehensive scientific-technical program for construction in the 11th Five-Year Plan the topic: "Developing and Introducing Effective New Enclosure and Load-Bearing Components of Brand 25-50 Arbolit With Densities of Up To  $700 \text{ kg/cm}^2$  for Various Types of Buildings."

In accordance with this program, we anticipate manufacturing 2.8 million cubic meters of arbolit items and components at enterprises of various ministries and departments in 1981-1985; production in 1980 was about  $150,000 \text{ m}^3$ .

Such optimistic forecasts are based on achievements in the area of scientific research and planning-design work, arbolit item and component production experience at enterprises of the USSR Minlesbumprom [Ministry of Timber, Pulp and Paper, and Wood Processing Industry] and Roskolkhozstroyob'yedineniye [not further identified] and experience over the recent decade in building various types of houses (Figures 1 and 2, reproduced at end of article).

Prior to 1981, research on this particular problem was done along various lines. The work was connected foremost with broadening the raw material base and preparing organic aggregates, including those from deciduous wood scrap, cotton stubble, rice straw, husks and other such materials, as well as with seeking out new types of mineral binders.

In this regard, we could note research done by the Alma-Ata NIISTromproyekt [not further identified] to develop effective methods of preparing aggregates from cotton stubble and husks and to develop and design specialized equipment for this technology and the appreciable contribution of the VNIIDrev [All-Union Scientific Research Institute of Woodworking Industry], which developed a standard flow line for preparing arbolit wood aggregate.

Encouraging results were obtained by the NIIZhB and TsNIISK [Central Scientific Research Institute of Construction Components] in using stressing cement, phosphogypsum and phosphate binders in arbolit. Using phosphogypsum as a binder, for example, enables us to simplify arbolit production, since it sharply increases the turnaround time of the forms and items do not need heat treatment.

Creating effective methods of preparing the arbolit mixture, perfecting the item molding and hardening processes, and developing methods of lowering cement expenditure and improving the strength and deformation properties of the items are important directions.

The arbolit mixture is presently compacted by vibropressing, vibrorolling, overload vibration, and so on. This technology requires metals-intensive equipment which is produced on an experimental basis and which, in a majority of instances,

does not provide production with the entire products list of items for various types of buildings.

The layer-molding method worked out by the "Sel'stroymaterialy" association is a step forward in this direction.

The NIIZhB has developed a porous ["foamed"] arbolit technology which has been thoroughly tested under laboratory and production conditions at the USSR Minlesbumprom's Oktyabr'skiy DSK [house-building combine] and the arbolit shop of the Gor'kovskolkhozstroyob'yedineniye's Shemanikhinskiy timber-management enterprise (Figure 3, reproduced at end of article).

Foaming the arbolit mixture permits compacting it without prestressing on ordinary vibrating surfaces. It becomes possible to manufacture a broad products list of items using the same equipment and flow-line/unit or conveyor technology. The Glavmosoblstroymaterialy [Main Administration of Building Materials and Construction Parts Industry of the Moscow Oblispolkom] has now adopted this method as the basis for building an arbolit shop with a capacity of 36,000 m<sup>3</sup> per year at the Domodedovskiy Building Materials Combine. However, in spite of the promise of the proposed technology, the USSR Minlesbumprom and Roskolkhozstroyob'yedineniye are not hurrying to introduce it into production.

Encouraging results have been obtained in manufacturing a pilot-commercial lot of large-format panels made from mobile unfoamed arbolit mixture using existing series-produced equipment for prefabricated reinforced concrete by the "Soyuznauchplitprom" VNPO [all-union scientific production association] of the USSR Minlesbumprom, jointly with the Glavmosoblstroy's Voskresenskiy DSK.

The Moscow Forestry Engineering Institute (MLTI) and NIIZhB have done research on accelerating arbolit hardening by various heat-treatment methods, including a.c. and d.c. electric heating, steam-curing and drying, warming up the arbolit mixture electrically, as well as autoclaving. Practically identical results were obtained for treating the arbolit with direct current (A. Pervovskiy's method) and alternating current. The most effective arbolit heat treatment is heating the items at 40°C and 60% relative humidity.

In view of the fact that heat treatment is the longest process in arbolit production, developments in this area are important.

According to NIIZhB data, treating organic aggregates with film-forming polymer additives has a substantial influence on the kinetics of strength accumulation, reducing arbolit hardening time and lowering cement expenditure. In this instance, arbolit strength was increased two- to four-fold and it could be heat-treated at up to 60°C without deterioration in the quality of the material. In this regard, item hardening time was reduced three- to six-fold and cement expenditure was reduced 20-30 percent without reducing the strength of the arbolit. However, the cost of this aggregate treatment is still high.

The NIIZhB KTB [technological design office], jointly with the VNIIDrev, has done a great deal of work to determine efficient protective-decorative finishes for arbolit wall components. Moreover, technology was developed for manufacturing arbolit wall units by sawing up large blocks.

Expanding arbolit production has been delayed in considerable measure by imperfections in the flow charts for manufacturing items. As a consequence, prior to 1981, there were practically no standard plans for arbolit production shops of various capacities. An analysis of production at existing enterprises belonging to various organizations shows that the technology is different at each of them and is far from optimum. There is therefore no plant today which could be used as a benchmark.

We can, however, note certain successes along this line. In accordance with the "Steps to Organize Large-Scale Production and Introduction Into Construction Practice of Arbolit Components and Items in 1980-1985," approved by the USSR Gosstroy, the USSR Minlesbumprom's Giprolesprom developed a standard plan in 1981 for a plant to produce 32,000 m<sup>3</sup> of arbolit components and items per year and the USSR Minstroydormash [Ministry of Construction, Road and Municipal Machinebuilding] Giprostrommash, jointly with the Roskolkhozstroyob'yedineniye's "Sel'stroymaterialy" association, developed a standard plan for a shop to produce 12,000 m<sup>3</sup> per year. Both standard plans are currently in the approval stage.

The next research direction is to plan and introduce effective new arbolit components. Thus, the Giprolesprom has worked out standard house and public building plans using arbolit-block walls, and the TsNIIPromzdaniy [Central Scientific Research, Planning and Experimental Institute of Industrial Buildings and Structures], with the participation of the NIIZhB and VNIIDrev, has worked out blueprints for arbolit wall panels and partitions for industrial buildings with six-meter column spacing.

Jointly with the NIIZhB and VNIIDrev, the Giprolesprom has developed and, together with the Oktyabr'skiy DSK, installed an experimental three-story house made of brand "25" arbolit with a density of 650-700 kg/m<sup>3</sup>. The span slabs are three-layer, the middle layer being brand "25" arbolit and the upper and lower layers being heavy brand "200" concrete.

During the construction, the 3.6- and 4.6-meter span slabs and wall units were tested for strength, rigidity and crack-resistance at the NIIZhB. A plan for a three-story house with enclosure and load-bearing components made of arbolit which was reworked with consideration of that testing has been approved by the RSFSR Gosstroy for repeat experimental construction.

The TsNIIEPgrazhdansel'stroy [not further identified] has worked out a products list and plans for individual-construction houses for rural areas using arbolit enclosure and load-bearing components manufactured using the layer-molding method approved by the Gosgrazhdanstroy. After span slab and outer wall panel testing, a single-apartment, three-room house in this series is being produced by the Izdeshkovskiy Experimental Plant.

Jointly with the NIIZhB, the MLTI has developed and introduced into large-scale construction in Krasnodarskiy Kray a six-meter three-layer arbolit outer wall panel for rural production construction (Figure 4, reproduced at end of report).

Krasnodarkraykolkhozproyekt, Gor'kovkolkhozproyekt and other planning organizations have created different types of individual plans for arbolit buildings. The Bryansk Institute (Giproplitprom) and MosgiproNII sel'stroy [not further

identified], with the participation of the NIIZhB, have produced a number of plans for foamed arbolit panel housing.

Much importance is being attached to working out new normative documents for arbolit. In particular, the VNIIDrev developed and approved 1979 USSR Minlesprom "Specifications for Arbolit Wood Aggregate"; the NIIZhB, jointly with the Roskolkhozstroyob'yedineniye worked out "Instructions on Planning, Manufacturing and Using Arbolit Items," which are now being approved in the USSR Gosstroy, and "Recommendations on Foamed Arbolit Product Manufacturing Technology." In 1981, a number of organizations were assigned the task, by the USSR Gosstroy, of reviewing GOST 19222-73, "Arbolit and Its Products. General Specifications."

Speaking of achievements in the field of developing the scientific-technical base of building and structure construction using arbolit components, we should also note existing shortcomings. The concentration of scientists engaged in research is inadequate. About 30 organizations are currently involved in the arbolit problem, but there is no comprehensive approach to solving important problems.

Efficient flow charts have not been set for preparing organic aggregates, there are practically no effective procedures for hardening items, and there are insufficient data on the strength and deformation properties of various modifications of this material, making it harder to design components.

Due to the lack of coordination among technologists in construction and wood-processing industry, comprehensive questions connected with the use of various types of wood in arbolit are being worked out slowly. Complete coordination of scientific research and planning has not been ensured. The production base of individual institutes (NIIZhB, VNIIDrev, TsNIIEPsel'stroy and others) is inadequately developed. Scientific developments on the economics of building with arbolit are being implemented slowly and there are few objective technical-economic indicators for arbolit production.

With a view towards further developing arbolit item and component production and improving their quality and effectiveness, we need to concentrate the efforts of scientific research and planning organizations, VUZ's and enterprises on working out and introducing the following important and promising directions in the arbolit field in the 11th Five-Year Plan:

- broadening research on and the use of noncement binders and deciduous wood; introducing efficient technological processes for preparing and manufacturing organic aggregates; reducing expenditures of cement by using complex chemical and film-forming additives and improving arbolit homogeneity by automating its manufacture; creating specialized mixing, batching and molding equipment; revealing the most efficient methods of reducing arbolit hardening time without reducing its strength and deformation properties;

- researching biostable and fire-resistant items made from various types of arbolit; improving the density, water-impermeability and corrosion-resistance of enclosure components for industrial and agricultural construction; mastering a variety of durable wall panel and block finished on automated conveyor lines in order to improve product quality and product output which is fully factory finished;

- developing and mastering an automated technology control system for the stage in which components are prepared and the mixture manufactured, in which

the reinforcing is protected against corrosion and the items are molded; determining efficient areas of arbolit item and component application; perfecting the methods of calculating and design components; intensifying quality control for technological processes and finished products, including the development of plant standards.

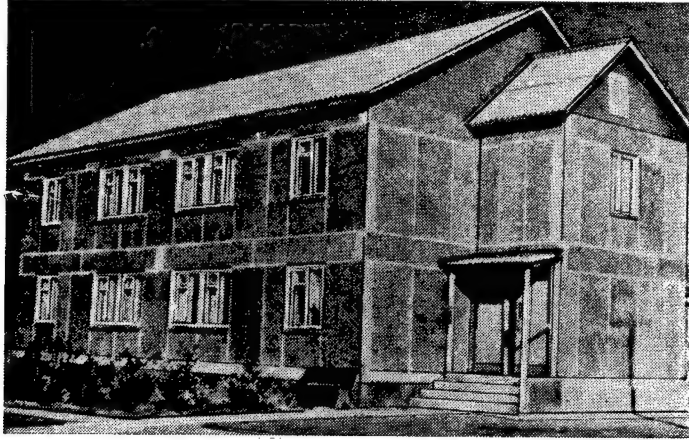


Figure 1. Two-Story, Four-Apartment Arbolit House

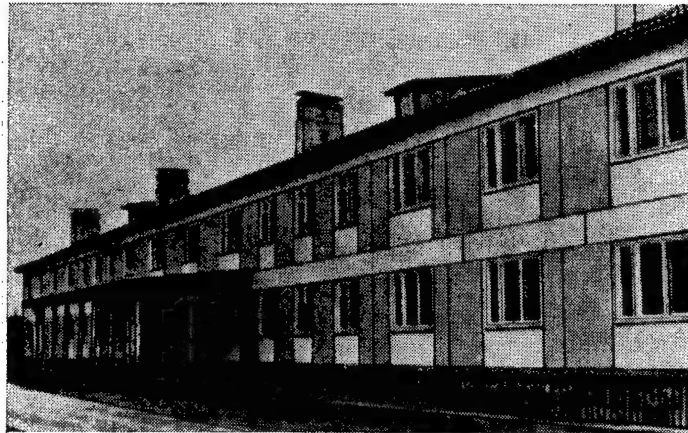
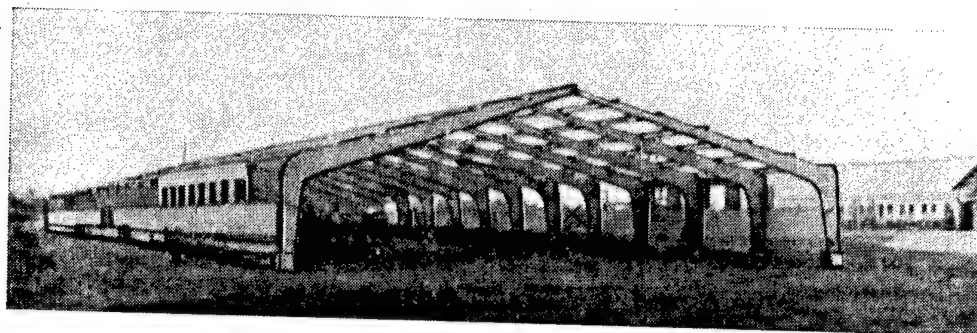


Figure 2. Dormitory for 102 Persons, Arbolit Outside Walls (Arkhangel'sk Oblast)

Figure 3. Foamed Arbolit Production Flow Chart



Key:

- |                               |   |
|-------------------------------|---|
| 1. S-951 Mixer                | a. Aggregates                             |
| 2. Arbolit dispenser          | b. Cement                                 |
| 3. Form                       | c. Foaming unit                           |
| 4. Roller conveyor            | d. Water and chemical-additives solutions |
| 5. Arbolit stacker            | e. To warehouse                           |
| 6. Vibrating surface          |   |
| 7. Cart with packet of forms  |   |
| 8. Heat-treatment chamber     |   |
| 9. Tilter                     |   |
| 10. Finishing conveyor        |   |
| 11. Cart with finished output |   |

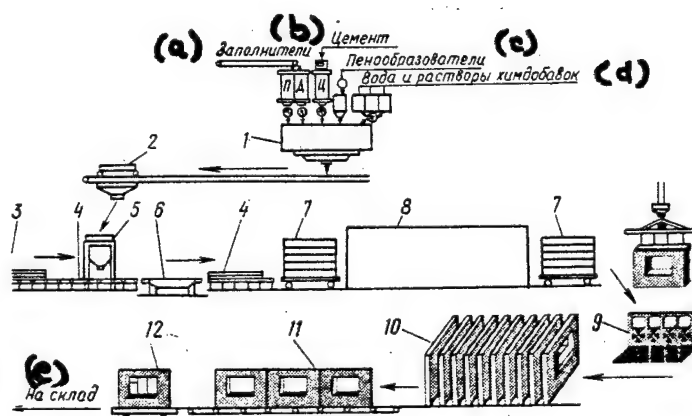


Figure 4. Installation of an Agricultural Building Using Three-Layer Six-Meter Arbolit Outside Wall Panels (Krasnodarskiy Kray)

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## Industrial Three-Layer Components

Moscow NA STROYKAKH ROSSII in Russian No 9, Sep 82 pp 11-13

[Article by Doctor of Technical Sciences A. Shcherbakov, department head at Moscow Forestry Engineering Institute: "Industrial Three-Layer Components"]

[Text] Arbolit production on a large scale will permit the simultaneous comprehensive resolution of several tasks, those of utilizing industrial wastes, revivifying the environment (eliminating piles of hemp and flax wastes from dumps, eliminating the burning of cotton stubble, rice straw, and treetops and brushwood), reducing the deficit of wall components, putting rural and forest settlement construction onto an industrial basis and, in so doing, lowering the demand for labor resources and saving the commercial timber used to produce the basic wall material, beams.

However, arbolit production remains poorly developed, as both its quality and efficiency do not meet modern requirements. The primary reasons are:

low enterprise productiveness, the resulting high output net cost and long periods needed to recompense expenditures on creating capacities; high expenditures of cement per unit of product; long arbolit hardening periods and hence a demand for many metal forms and much production space; lack of standard technological equipment, and in particular, that for preparing quality aggregate and arbolit mixture and for molding products; inadequate product quality, especially during the winter; low industrialness of components (upwards of 80 percent of the arbolit products in the country are produced as small wall blocks which are either unfinished or finished on one side only); high commercial wood expenditure to install spans, roofs, floors, and so on.

In order to sharply improve arbolit quality and the effectiveness of using it, we need to plan enterprises with capacities of 25,000, 50,000 and 75,000 m<sup>3</sup> of product per year. This opportunity results from the availability of raw material and the experience which has now been accumulated in manufacturing this promising material.

Thus, for example, the Kurganinskiy Arbolit Plant (Krasnodarskiy Kray) is steadily producing upwards of 20,000 m<sup>3</sup> of products per year in one span. Given installation of similar flow lines in two or three spans, it could realistically produce about 100,000 m<sup>3</sup>. It is easy to set up the release of unitized monotypical components on each flow line and to ensure a high degree of production process mechanization and automation at such enterprises.

Designing arbolit components and planning a products list for various types of buildings with consideration of the properties of the material are of substantial importance. As is known, arbolit has a high thermal insulation capacity but relatively low strength and high deformation. Negative aspects include its shrinkage and swelling, creep and maximum compressibility.

Physical studies made by us in different climate zones of the country showed that, when the requirements of GOST 19222-73 are met with regard to the design, manufacture, installation and operation of various types of buildings made of arbolit, satisfactory results are obtained. If those requirements are not met,



under prolonged constant load conditions, deformation increases in arbolit components, leading to the formation of both vertical and horizontal joint cracks, as well as cracks in building corners and wall surfaces.

Surface-finish layers of a cement-sand solution applied after molding often peel off. As a result, the components get wet and are damaged by wood-decaying fungi in the summer and frost in the winter. Wall panel sagging has been observed in many buildings.

The high deformation and low load-bearing capacity of arbolit components also result from the fact that arbolit adhesion to the reinforcing is very low (0.1-0.2 MPa). Ordinary reinforcing anchoring in arbolit does not do the job, due to its low resistance to local compression. Moreover, arbolit reinforcing is subject to corrosion.

It is therefore appropriate to design for it flexible and load-bearing components working on eccentric compression, multipurpose components such as three-layer ones which would advantageously combine the thermophysical properties of arbolit and the strength properties of reinforced concrete.

One example would be the 6 x 1.2 x 0.2-meter three-layer wall panels for agricultural and industrial buildings which have been developed by the MLTI and whose production has been mastered by the Kurganinskiy Arbolit Plant (Figure 1, reproduced at end of article). The basic middle layer is brand "15" structural-insulation arbolit with a density of 600 kg/m<sup>3</sup> and the outer layers are made of reinforced heavy or light concrete 35-40 mm thick.

The front side of the panel can be finished like a "lunar surface" with brick, glass, ceramic or other tile. The panels are secured to the frame simply and safely with inlaid fasteners (Figure 2, reproduced at end of article).

Test results show that panels of this design have high strength and rigidity. They are manufactured on standard molding equipment for reinforced concrete products. They can also be heat-treated using the same procedures as for reinforced concrete.

Thus, items are broken out of the molds in 12 hours at the Kurganinskiy Arbolit Plant, as against 4-5 days at other enterprises. The reduced arbolit hardening time permits an eight- to 10-fold reduction in mold turnaround time. It is for good reason that this plant is currently the most highly productive in the branch.

Such designs also permit a reduction in cement expenditure to 100-120 kg/m<sup>3</sup> and a reduction in weight due to the ability to use a lower grade and a decrease in the volume of the inside arbolit layer. They will be especially effective in the Far North, Far East and Siberia, where a thermal insulation layer 30-40 cm thick is required where there is resistance to heat transfer. And the possibility of heat-treating using reinforced concrete procedures enables us to save thermal energy and reduce the number of metal molds and amount of production space, currently planned for holding finished arbolit products for seven or 14 days.

Sharp improvement in arbolit production technology is of great importance. All enterprises now operating were built from individual plans, operate using various

technological arrangements and produce a variety of items, often using binders and aggregates not recommended by GOST 19222-73, which leads to poor-quality material.

Research done at the MLTI has established that the following conditions must be met to improve arbolit quality and the efficiency of its manufacture:

holding the wood raw material at above-freezing temperatures for 1.5 to two months; preparing the organic aggregate must be done by two-stage grinding, sifting out the small and large fragments; using at least "400"-brand portland cement, preferably quick-setting, as the binder; using chemical additives consisting of liquid sodium silicate and potassium chloride, potassium chloride and aluminum sulfate or iron sulfate, potassium hydroxide and potassium chloride; eliminating prewetting; batching components by weight in strict conformity with the optimum mixture composition; preparing the mixture only in forced-agitation mixers and batching it only for one item;

molding three-layer components "face down" on standard vibrating surfaces, with subsequent calibration on a vibrating roller and finishing as for reinforced concrete; heat treatment using procedures close to those used for reinforced concrete items; finishing the joints with special plastic seals and pointing them with a warm slurry; in buildings to be used under high-humidity conditions, installing a reliable vapor barrier on enclosure components; avoid wetting components during operation and ensure that they dry out thoroughly.

Research by the USSR Gosstroy's NIIES [Scientific Research Institute of Construction Economics] has established that the main expenditure item in arbolit production is the cost of materials (26-45 percent); wages comprise 18-43 percent, shop expenditures (including depreciation deductions) -- 12-42 percent, general plant expenditures -- 7-9 percent, electricity and fuel -- 5-6 percent.

Such expenditure items as raw and other materials, wages and shop expenditures thus comprise the highest proportion in the production of arbolit wall components.

Based on this, arbolit net cost can be lowered foremost through an optimum choice of mixture composition which will ensure a reduction in cement expenditure to 25 percent, comprehensive mechanization and automation of the entire technological process, and the use of poor-quality softwoods, scrap lumber, machine-tool shavings, scraps from tannin-extraction industry, and hemp and flax scutch.

Standardization and increasing component size, reducing the number of component type-sizes, are also necessary conditions.

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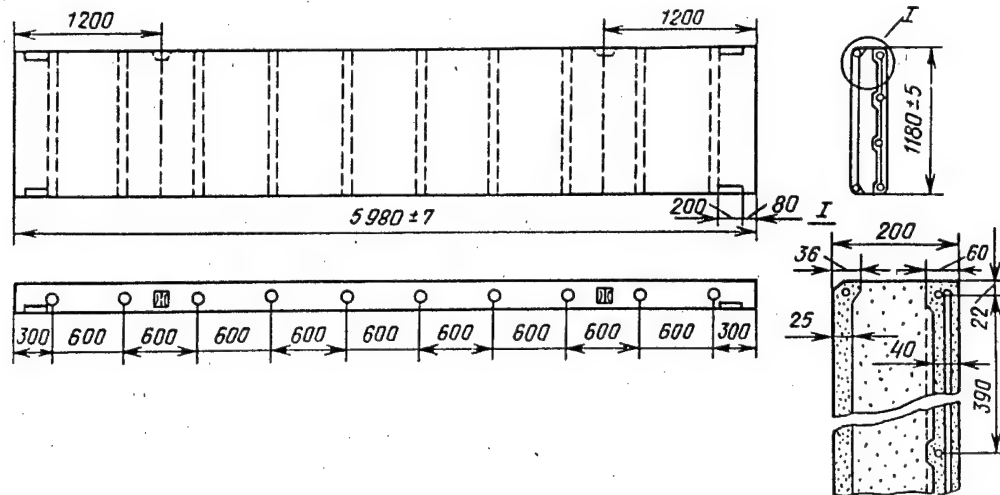


Figure 1. Three-Layer Arbolit Components for Industrial and Agricultural Buildings

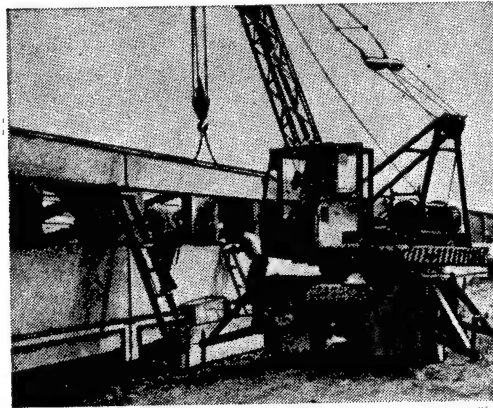


Figure 2. Installing Three-Layer Arbolit Component Agricultural Buildings

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## BUILDING MATERIALS

### RED TAPE RETARDS INTRODUCTION OF SILICATE CONCRETE

Moscow STROITEL'NAYA GAZETA in Russian 26 Nov 82 p 3

[Article by V. Annenkov: "Cement Barrier"]

[Text] I don't know if what was put together by the German researcher Michaelis was primarily a healthy curiosity. However, facts are facts: He was the first to put a mixture of lime and sand in an autoclave, keep them there for eight hours at a pressure of up to 8 atmospheres of steam, and to discover that they had turned to stone. Yes, it is a strong, artificial stone which is completely suitable for construction. Since then, which was back in the 1860's, silicate construction materials, materials without cement, have developed their genealogy. There have been gradual improvements in technology and in construction and technical characteristics. Who knows by what paths major construction would have developed if it had not been for the triumphal procession of cement. Cement structures have rightfully won the dominant position and today continue to have a firm hold upon it, although for many decades now there has existed, and there continue to be improvements upon a technology for the manufacture of cellular silicate concrete. Its porous structure gives items made from it truly remarkable properties, obtained by the addition of an aluminum powder mixture. This results in light panels or blocks. This characteristic alone is very attractive to builders, as it reduces labor and transport costs. However, it by no means exhausts the advantages of cellular silicate concrete. The material is an excellent retainer of heat in buildings and is easily worked. With regard to this quality cellular silicate concrete is as good as the oldest building material, wood, and with regard to its sanitary-hygienic qualities it is better. Walls made from this material retain heat, and as they say, they "breathe".

### If One Calculates The Advantages

Large dimension items made from dense silicate concrete, the technology for the mass production of which was first created here in our nation by VNIISTprom [All-Union Scientific Research Institute of the Construction Industry] imeni P. P. Budnikov, are, with regard to their technical qualities, practically identical to parts made from regular cement concrete. However, there are substantial differences in production processes, which result in different economic characteristics. One cubic meter of silicate concrete requires 150-180 kg of lime, while the same quantity of ordinary concrete with the same strength uses 300-400 kg of Portland cement. Thus, the first has 40 percent less energy in an embodied form than the latter.

One can use metallurgical or fuel slag as a binding component during autoclave hardening in the production of dense silicate concrete. In such case the economic effect will be even greater: The production cost per ton of Grade 500 binding slag is half that of a similar amount of Portland cement.

Finally, it is difficult to even roughly estimate the advantages to the national economy from the introduction of silicate concrete, opening broad possibilities for reducing transport. Thousands and thousands of freight cars haul cement and gravel. They stand idle waiting for loading and unloading. There are chronic shortages of rolling stock, and freight cars break down frequently. The intensity of these problems can be significantly lessened.

Here is the opinion of Ye. Leont'yev, VNIISTprom department chief:

At first glance there is no special difference, after all it is necessary to deliver raw materials -- sand and lime -- to a silicate concrete plant. However, the big fact is that the quality requirements for, say, sand, are lower with this process. The reserves of coarse sands, used in the production of cement concretes are not so great. The introduction of silicate concrete makes it possible for enterprises to use deposits of fine sands, and they account for almost half of all explored reserves.

For this concrete one does not need any gravel. As you know, the problem of gravel used in cement concrete production has now grown into a very acute one in, for example, the Non-Black Earth Zone of the RSFSR, a number of oblasts in the Ukraine, Belorussia and West Siberia. It frequently must be hauled 1,000 kilometers and more. As a result the cost of the aggregate increases 3-4 fold.

Ye. Leon'tyev's opinion is supported by A. Gryazin, department head at the Mari Polytechnical Institute in calculations in a letter sent to the editor: "...the replacement of only 1 million cubic meters of precast cement concrete elements by silicate concrete ones would save 250,000 - 400,000 tons of cement and set free 5,000 - 8,000 freight cars. The volume of raw material transportation for highway concrete, calculated per 1 square meter of highway slabs of silicate concrete would be 70-90 ton kilometers lower."

Thus, the advantages have been calculated and weighed, and state standards have been approved. It would seem that there is only one thing left to do: introduce

it. However, there have been repeated difficulties with its introduction. For over 12 years the production of dense silicate concrete has remained at the 500,000 cubic meter level. During the same period the production of cellular concrete has increased from 1.5 to 6 million tons, but it is much below the planned level.

### Is technology Guilty?

A Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] representative is inspecting the automated line at the Grodno combine, which produces 55,000 cubic meters of dense silicate concrete annually. It is a serious occasion. There are suggestions to build such a plant near Tyumen, where there is neither cement nor gravel.

"What is your impression"

"Remarkable! Only, here are...the autoclaves..."

Furthermore, there are inconsistently expressed doubts: it is said the pressure is greater, and somehow dangerous, and it is troublesome to get the State Committee for Supervision of Safe Working Practices in Industry and for Mine Supervision to approve... It is the problem of the steam chamber. And in general the technology is more complex than the traditional.

The chief of Glavneftegazpromstroyaterialov [Main Administration for Petroleum and Gas Industry Construction Materials], P. Kuzin, whom I called, and who had just returned from Grodno to Moscow, pointed to a completely different reason why the ministry had turned down the project: its too far to haul the lime.

Of course, there is no danger in working with the autoclave (all the less with automatic control). The reference to lime transport looked like an excuse, as it is also necessary to haul cement and gravel, and in much greater volumes.

There was a special discussion about the technology's complexity. An acquaintance with the line at the Grodno construction materials combine forced one to think if this were really a negative factor.

A. Belen'kin, the combine' director, told me in this regard: "In my opinion, one should not speak of the technology's complexity, The epithet "exacting" is more suitable. Here, perhaps, you are right in your doubts, this very exactingness, by requiring the use of automatic equipment, has played a positive role, primarily by strengthening discipline and improving the prestige of our production work. This is important in retaining key personnel.

Batch laying machine operator Boris Spodar', a shy fellow with glasses dressed in elegant coveralls, climbed down from this completely glass enclosed cab.

"Of course," he said, "young people gladly go on this line. Here there are automats and complex instruments. Work conditions are better But what is the main thing? It is working with modern technology. This is very important for a young worker."

On Gorkaya Street in Grodno there are a number of inhabited buildings with exterior walls made of cellular concrete, while the exterior walls and roofs are made from dense silicate concrete. Specialists and production workers consider this an ideal combination.

The combine director continues: "We are ready today to supply 94 percent of builder's parts and structures for homes in a noncement version. However, the only problem is that once produced it would be difficult to sell them, even though there are no complaints about quality."

Why aren't builders eager for items made from silicate concrete. Practically all specialists to whom I posed this question pointed to the psychological barrier as one of the main reasons.

Z. Olendskiy, head of the Labor and Wages Department at the Grodno combine, admitted: "You know, I have been living in a silicate concrete home for several years and still cannot get used to the fact that there is no cement in the slabs. I know that they are as strong as ordinary cement ones, but somewhere in my mind there is a doubt about the unusual."

I think, however, that such doubts can be overcome. Another circumstance is more serious. Doubts are hidden under various masks. Those who are afraid of the new will find any excuse.

For example, G. Sedov, the chief engineer at the construction administration of the Main Administration for Water Resources Construction in the Non-Black-Earth Zone refers to their large proportion of water resources engineering installations. It is said that silicate concrete is not suitable for them. It is not clear where this was learned, as such research has not been conducted. In addition to water projects, the main administration has lots of other work. In some places their gravel requirements are only 30 percent met.

"What, in your opinion, will cover the shortage?"

"There are deposits in our zone, they must be developed rapidly, and new pits dug."

Well, let us. Let us find millions of rubles for the development of new deposits, let us destroy unique natural formations such as the Zhigulevskiy Hills... and then seek new millions to restore them (although they will not create new Zhiguleys for us). In the meantime we will haul gravel to Moscow from Karelia and to the Volga area from Central Asia.

### Groundless Fears

Perhaps it is worth it to stop and think it over? Not everywhere, and not once and for all, of course, but where are there favorable conditions for the production of dense silicate concrete as an alternative to the production of cement concretes? This was done, for example, at the RSFSR Kolkhoz Construction Association, which organized the production of highway slabs from this material at Velikiye Luki, and is planning the construction of a new plant in Gorkiy Oblast.

"However, this is the sole example," said M. Rusina, chief of the Wall Materials department at the USSR Ministry of the Construction Materials Industry. "no, that's not true, the Ministry of Power and Electrification built a plant producing silicate concrete panels in the Yakut city of Aykhal."

Other ministries, even purely construction ones, are making every effort to avoid the mastery of this material, which is new to them. Some say that they fear the autoclaves, others that their funds for cement have been cut off; a third group refers to a lime shortage, while a fourth fears that production will turn out to be less profitable than for cement concrete.

There is perhaps no point to dwelling upon the first two points, as their groundlessness, and even lack of seriousness is obvious. There is, to some extent, a lime shortage. However, it is easier to overcome than the shortage of cement and gravel. As far as the last argument is concerned, look at these telltale figures: The full production cost per cubic meter of interior wall panel at the Grodno construction materials combine is 33.02 rubles, at the Moscow No 9 ferroconcrete product plant it is 43.62; while the respective figures for roof slabs at these enterprises are 38.34 and 46.15 rubles. These are not theoretical calculations in an office, they are real indicators obtained from series production.

"Well, and your ministry," I turned to Rusina, "can't it really build an enterprise for silicate concrete items?"

"The trouble is it can't. Such plants must be financed according to the "Ferroconcrete" schedule which is made up by a USSR Gosplan special subdepartment for construction ministries. We can only plan the production of small dimension wall materials, this is the sphere of another subdepartment."

In short, it's like the Georgian toast: Some want, but cannot, others can, but don't want to. Nevertheless, the Ministry of the Construction Materials Industry could build an automated line in Grodno. However, even here everything is based upon the position of builders and designers: the output is sold with a certain "squeak" (skripom).

Oleg Shamov heads the institute's introduction sector, now constantly registered in Grodno.

"All this is true", he said, from time to time rubbing the left side of his chest with his palm, "all the reasons of which you spoke do apply: the structure of the Gosplan subdepartment and the fear of the new. At first glance the technology is complex and there is a psychological barrier. However, in my opinion there is another reason -- a sort of thoughtless copying of Western experience. Look, cellular concrete is being actively introduced by many capitalist firms, while here it is going badly, and dense concrete not at all. Why? Sometimes I am answered with a question in return: 'And why don't the capitalists use it? Are they fools?'".

The fact is that construction firms in the most developed capitalist nations have not given themselves this goal. Throughout the world the number of quarries and pits continues to grow. Our socialist society is vitally interested in



protecting the environment. For this reason we should ponder about whether or not it is necessary to endlessly make "scars" on the face of the earth, and if it is possible to get along with less cement and gravel.

Incidentally, this is well understood by our colleagues in the GDR. They are so interested in the technology for the production of dense silicate concrete that they have signed a contract with us for the joint construction of two automated shops: one in Grodno and one in Milnersdorf. This contract has been implemented. Now specialists from several developing nations have indicated interest in our experience.

In the GDR the opening of the new enterprise was marked as a great event. It was conducted in a festive atmosphere, attended by party and stage figures.

How was the opening of the Grodno combine celebrated?

There was almost no notice at all. Well, there were a few short press announcements, and that it all. For me personally, the remembrances are unpleasant, shortly after its introduction, I suffered an infarction. Well, it is true, it did not relate to the essentials of this matter.

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